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[ILLUSTRATED.]

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Time Detector.

The Rosebrook Time Detector for police service and watchmen is illustrated in figures 1 and 2. Three dials are operated in this system by using mechanism in combination with electricity, each serving a purpose, but all acting in harmony.

In cut Fig. 1 the clockwork and mechanism is shown. This instrument is placed in the office, securely locked, the office is also locked, so watchman has no access to it. *D* is the time clock on which is the ordinary time dial, making it a perfect office clock. This clock is hinged and held by a hook; on the back side of clock mechanism is placed the time paper dial, as shown in Fig. 2. This dial is revolving on stem of minute hand, a needle in the mechanism back of this clock is forced through this time paper dial every time the button at the proper station is pushed, thus recording the exact time the watchman or policeman visited this or that station. Dial *A* is an indicating dial; the hand on this dial will move one point every time a button is pushed at the proper station, providing the watchman is promptly on time at his station. If he is over five minutes late at his station, this hand will not move and will make a record against the watchman. The reason why it will not move is that its connections are in the circuit only once in every half hour and then for five minutes only; after the five minutes the time clock in its revolution cuts this circuit out and it cannot be restored until twenty five minutes later; thus it is easily seen that the watchman, in order to make his record on this dial, must be promptly on hand at every station during the night. It is only the entire accuracy of this tell tale dial that brings the watchman or policeman up to a state of efficiency obtainable in no other way.

The recording dial, Fig. 2, is placed on back of clock *D*; this is a 12-station dial for every half hour; the stations are in white letters on the black outer circle and the hours are in next circle in black letters. The watchman commences his duty at station 1 at six o'clock, the dial is divided in five minute divisions, and the needle punctures the paper in this white circle whenever this puncture occurs, showing the exact time at which it was made.

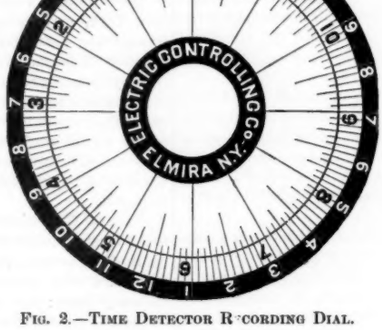

FIG. 2.—TIME DETECTOR RECORDING DIAL.

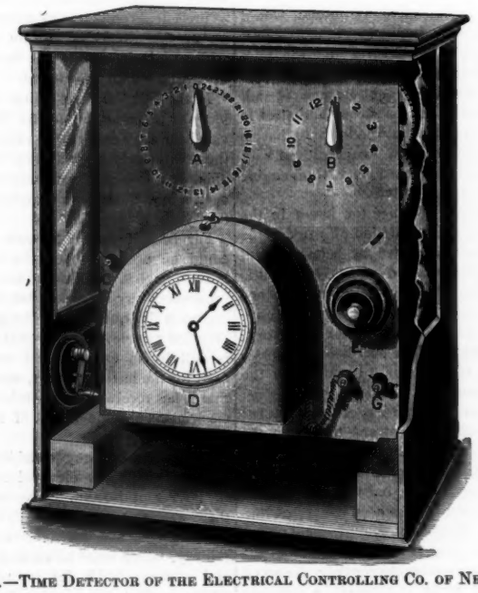

FIG. 1.—TIME DETECTOR OF THE ELECTRICAL CONTROLLING CO. OF NEW YORK.

A New Use for Electricity.

A party named Henri Roget, hailing from Lyons, France, has a new use for electricity. He has a patent to apply it as a substitute for the cat-o'-nine-tails in corporal punishment. The culprit having been undressed is securely strapped to a steel triangle, which is connected with one pole of a powerful battery. The other pole is connected with the whip, which consists of a number of steel wires covered with sponge. The whip is dipped in water before the stroke is administered, and wherever the wet wires touch an electric discharge takes place.

The inventor claims that the chastisement can be made so mild as not to injure a schoolgirl, while on the other hand, by increasing the power of the battery, a punishment can be administered beside which the knout would be mere child's play, and at the same time no injury is inflicted, the disgusting spectacle of a lacerated back is avoided, and the culprit, instead of having to be sent to the hospital to have his wounds healed, can be put to work in five minutes after the flogging is over. M. Roget intends petitioning Gen. Boulanger, the minister of war, to allow his patent to be used experimentally on the next soldier sentenced to the cat. Flogging is not in existence in the French army, nor is it likely to be introduced to test the machine.

Adverse to Elevated Roads.

Following the appearance before them of Mr. C. J. H. Woodbury the committee on street railways, of the Massachusetts Legislature, will report reference to the next Legislature on the various petitions for elevated railroad charters. The committee is said to have felt that the time has not yet come to say that electrical elevated roads are a success, and to think that the methods should be more fully developed before any charters are granted.

Elevated Electric Railways at Boston.

AN ABLE REVIEW OF THE SITUATION BY MR. C. J. H. WOODBURY.

There have been numerous hearings before the Committee on Street Railways of the Massachusetts Legislature, upon the petitions of various parties desiring charters for authorizing the construction and operation of elevated railways over the streets of Boston. The leading systems of electro motors were represented before the committee, who were also taken to New York to examine the electro-motors here. The leading expert testimony on the side of the petitioners was furnished by Lieutenant Francis J. Sprague, who read before the committee the lecture upon the "Application of Electricity to Propulsion upon Elevated Railroads," which he delivered before the Society of Arts at Boston, Dec. 10, 1885, and which was reprinted by several papers at the time, and will be remembered by those interested in the subject as one of the most detailed statements of the matter which has been presented before the public.

The granting of these petitions was opposed by numerous owners of real estate, and on behalf of the remonstrants, Mr. C. J. H. Woodbury submitted the following testimony, giving reasons why it would be inexpedient to grant charters for the construction of elevated electric railroads:

ELECTRICITY AS A MOTIVE POWER FOR ELEVATED RAILROADS. BY C. J. H. WOODBURY, OF BOSTON.

The use of electricity as a motive power forms the earliest application of electricity to industrial purposes.

The adaptability of electric energy for conversion into work, under conditions peculiarly favorable for convenient use, promises an extensive field for its application to commercial uses in a manner which has attracted capitalists and occupied scientific men.

The Emperor of Russia in 1835 was the patron of Jacobi in the construction of a boat propelled by electricity. Congress appropriated $30,000 for the experiments of Prof Charles Page, of the Smithsonian Institute, a citizen of Salem, Mass., in 1850. And at the present time the French branch of the House of Rothschilds is reputed to have expended 2,500,000f. for the experiments of Duprez upon a system of electro-motors which destroyed itself at a recent exhibition.

Among the various claimants the weight of evidence gives to an Abbe Salvator del Nigra, at the University of Padua, the priority for his motor built in 1831. The electric boat of Jacobi had been referred to. Independently, Davidson of Vermont, invented an electro-motor, which was used to run the press which printed a newspaper, *The Electro-Magnetic and Mechanical Intelligencer*, at Philadelphia in 1836; and the year before he exhibited an electric railway in Boston. Thus the matter progressed in the hands of various inventors, notably Prof. Moses G. Farmer, of Salem, and Thomas Hall, of Boston. In 1841 there was much enthusiasm over the assumed commercial importance of these electric engines, which were operated by electric currents generated in the expensive manner by batteries.

The liberal action of Congress in making an appropriation for Prof. Page enabled him to build an electric motor weighing 10½ tons, which ran the five miles between Washington and Bladensburg in 39 minutes and then became disabled through some practical defect with the batteries.

These extended citations have been made to call attention to the state of the art 30 to 50 years ago, when these projects received unusual attention, and at a time when the value of inventions was not generally recognized.

But little more was done upon this subject until 1873, when a workman at the Paris Exposition by a blunder connected the wires of two Gramme dynamos together, and it was seen that the electricity from one dynamo caused the shaft of the other one to turn rapidly, and from this incident the principle of the reversibility of the dynamo became known; apply power to a dynamo, and it

produces an electric current, apply electricity to a dynamo and it gives forth power. The late Clerk Maxwell declared that this formed the greatest scientific discovery of the present century. Supplying a missing link in the practical exemplification of the theory of the conservation of force, it formed an appropriate climax of the new discoveries in physical science, which were begun by the investigations of Dr. Joule on the mechanical theory of heat, which has been the foundation of the present science of thermodynamics, a work which was entered upon by Dr. Joule in consequence of certain inquiries upon the principles of the Page motor in 1850.

Apart from any theoretical consideration, this new discovery of the reversibility of the dynamo contained the promise of a matter of great commercial value and practical utility, for the electricity from a dynamo cost less than one twenty-fifth of that produced by batteries.

During the next few years, while the development of the electric lighting industry was assuming its present widespread proportions, a great deal of attention was given to the matter of electric motors—on paper. The circulars of the electric light companies abounded in promises concerning the electro-motors which they would shortly place upon the market; and sharing this enthusiasm, more than half of the electric illuminating companies were chartered as electric light and power companies, but until a year and a-half ago not one of these companies ever exercised the portion of their franchise permitting them to sell power; and to-day the trivial amount of power furnished by electro-motors, where the current is taken from the wires of a central station system, is so small a portion of the capacity of these central lighting stations that the matter of the sale of power might be considered an exception, which proves the rule.

The whole consideration of the practical application of electro-motors has been expressed in the future tense; the hopes of inventors and wishes of capitalists to fill the demands for a practical electro-motor have accomplished little except promises.

There is a great demand for such small powers as could be furnished by an electro-motor, and the electro-illuminating companies are exceedingly desirous to avail themselves of any motor which will enable them to supply their customers with power, and thus operate their present lighting plant during the daytime, when it is now idle; and it is generally admitted that a commercially successful system of motors would exceed the present business of electric illumination.

But the requirements of automatic regulation, obtaining uniform speed with varying loads, economy and management by relatively unskilled labor, such as is demanded of all motors, water-wheels and steam engines, have proven severe conditions for electro-motors.

Electro-motors have been used on numerous short lines of passenger railway in places selected where the conditions would be peculiarly favorable for any street railway. Such railways at the interior of large exhibitions and the approaches to such fairs, also places of popular resort and recreation at the sea-shore, have proved very successful enterprises, where a constant patronage of pleasure-seekers at high rates of fare filled the small cars; but until within a few months there has been no serious attempt at the operation of electric railways in this country for general public use in the same extent and manner that horse cars serve the purpose of city transportation. These have all been on a small scale, serving as experiments preliminary to what is expected to be accomplished on a larger scale. There is truly a demand for some other motor than horse flesh for street cars. Dummy engines received faithful trial, and were abandoned years ago as utterly unfit for the purpose. Tired of waiting for the realization of the promises of electro-motors, cable traction roads have been introduced in places where they could be applied in the straight streets of checker-board cities.

The few electric street railways have two or three cars, each of them generally drawn by a dummy containing the electro-motor; sometimes the motor has been placed upon the car, and a 50 horse-power generator would furnish the electricity for the whole line.

The conditions of these surface street railways bear little relevancy to those demanded for elevated railways, and even successful results upon them could not be used as a basis of what might be expected from their application to elevated railways.

The cars of a street railway must be small, run at moderate speed, start and stop at the whim of patrons, and in fact serve every purpose now supplied by horse or cable traction cars. With elevated railways, the conditions are widely different, the demand to carry large numbers of passengers at the greatest speed practicable requires larger cars joined together in trains, and the speed between stations must be as great as will be practicable without swaying and jostling the passengers when stopping and starting the trains.

In most respects there can be but little difference between the present use of steam and any form of electro-motors. The trains and speed must be the same.

The tractive force of a locomotive, whether steam or electric, is limited by the pressure of the drivers upon the rails. The strength of the elevated structure must be the same in either case, not in regard to any slight difference between vertical components of stress due to a slightly greater or less weight of the locomotive, but it must resist the horizontal stresses applied to the roadway in starting and stopping trains.

Bearings must be lubricated in the same manner whether electricity or steam be the motive power. It was never urged that the machinery of a mill required more or less lubrication according to whether a water wheel or a steam engine furnished the motive power.

It would not be practicable to run a train moved by independent electric motors under each car, as the motors could not be run in exact unison, particularly in stopping and starting trains. The electro-motor must be a locomotive and must carry two men, even if there was work for but one of them, for the safety of the traveling public would demand two men in an electric motor, as it does upon steam locomotives and the pilot house of vessels carrying passengers.

There is, however, one element of admitted difference in the steam and electric systems of elevated railroads, and that is fuel can be burned and steam utilized with greater economy in a stationary steam engine plant than in a locomotive.

It is unproven whether the losses in the long cycle of the production of work in the steam engine, transmitted by belts and pulleys to the generating dynamos, where it is converted into electric energy and thence transmitted along the conductors to the electric motors and reconverted back into work, is not attended with a succession of losses sufficient in the aggregate to outweigh the the greater economy of the stationary engine.

Certainly such an increase of economy has not been disclosed in regard to any of the small surface street railways in experimental operation. In the famous Port Rush Electrical Railway, only one-quarter of the power of the water wheels is converted into work by the electro motor in practical operation, and it requires a man constantly at the gate of the water wheel to regulate the speed of the wheel, so as to preserve a constant current in the electric conductors.

This railway system was designed by some of the leading electricians of England, and the results are probably as good as have been obtained elsewhere.

The elevated railway system of New York requires some 5,000 horse-power, yet the largest dynamo machines in practical use for incandescent lighting are the large Edison dynamos driven by a 125 horse-power engine, and weighing over 60,000 pounds, and the largest Brush dynamo for arc lighting requires some 40 horse-power, and there has not been any instance where a sufficient number of electrical generators of any kind have been connected with each other to an extent at all comparable with the great amount of work required on an elevate railway system.

There was an opportunity to apply electro-motors to transfer cars across the East River bridge, but no one was ready to enter upon such an undertaking. The directors of the elevated railroad made a most flattering offer to inventors of the several systems of electric locomotion upon a plan which was expected to reach consummation about fifteen months ago. The result has been that one motor, of less than half the power of the locomotives used on these roads, made its trial trip on the 26th day of August, 1885, and the public certainly have no knowledge that it is in a working condition. Of the other systems little is known beyond the fact that no results have been made public.

At New York, the committee saw the results of a year and a-half of opportunity to apply electricity as a motive power to the trains of the elevated railways.

It is not my purpose to belittle the work of either of the able electricians who have devoted much skill to this problem, but I submit that a single car, running for exhibition purposes on a short piece of elevated track, is no criterion of what might be expected from an attempt at its application to a complete elevated railway system, with its varying service of continuous trains. If either of these systems should ever be applied on an extensive scale to the elevated railways of New York, performing the same work in transporting passenger trains which is now required of locomotives, and if this electrical system, after an extensive trial, should bear a satisfactory comparison with the present methods, both in respect to the character of the service performed and its cost, then there would be an opportunity to consider the question of its applicability to rapid transit in Boston.

I have no disposition to ignore facts relative to the various surface electric railroads with a plant of one or more small cars, which have been tried with varying degrees of success for many years; but, even if they were not all more or less experimental their conditions of operation are so different from the case under consideration that they cannot be cited as precedents sufficient to warrant the giving up of the streets of Boston to a project which must, in view of the facts submitted, be considered an experiment.

If these experiments which have been so long in preparation for the New York elevated railways ever reach satisfactory results, they will form a great step in advance of what has hitherto been accomplished, and open a new field for an application of electricity.

Far be it from me to utter a word that could be used in opposition to any public benefit, or that would serve as a check to the progress of any invention, but the facts bearing upon the question of the application of electricity to elevated railroads show that it is still in an experimental state, as it has been for the last fifty years, notwithstanding that it has received the attention of the ablest electricians and the benefit of large amounts of capital.

Irrespective of any consideration of the exigency requiring elevated railroads over the streets of Boston, it does not seem as if there were any grounds justifying the granting of a franchise for an elevated electrical railway, which must be another experiment, and perhaps hold the occupancy of the streets against some other form of rapid transit.

Decision in Favor of the Bell Company.

AN INJUNCTION GRANTED AGAINST THE NATIONAL IMPROVED TELEPHONE COMPANY AND OTHERS— A LENGTHY REVIEW OF THE LAW AND EVIDENCE IN THE CASE.

In the case of the American Bell Telephone Company *et al.* against the National Improved Telephone Company *et al.*, Judges Pardee and Billings, sitting *en banc* rendered the following decision, at New Orleans, May 31st:

In this case J. J. Storrow, T. J. Semmes, Bayne & Denegre and E. N. Dickerson represented complainants, and J. R. Beckwith, Farrar & Krutschnitt and A. G. Brice for defendants.

Circuit Court of the United States, Eastern District of Louisiana—American Bell Telephone Company *et al. vs.* National Improved Telephone Company *et al.*—Before Don. A. Pardee, Circuit Judge, and Edward C. Billings, District Judge. This cause is before us on an application for a preliminary injunction by Bell, answers, numerous affidavits, depositions and exhibits. We heard the application discussed by the solicitors on both sides, with many adjuncts of experiment and illustration, for the period of twenty-one days, and we have striven to give to the question the study and consideration to which it is entitled, from the fact that so many of our fellow-citizens throughout the entire country are interested in its decision.

A very long discussion, in which solicitors of ability and learning participated—such as has been the one conducted before us—has one great advantage, it tends to separate by a clear line of demarcation that which is sound in law and sustained in fact from that which, however plausible and forcibly urged, analysis and proof compel the abandonment of.

The complainants have urged that since the patents involved here have been the subject of judicial investigation, ending in decisions in the Circuit Courts of the United States maintaining their validity, that so far as the issues presented in those causes have been identical with those involved in this cause, for the purposes of granting a preliminary injunction to run *pendente lite*, those prior decisions elsewhere obtained are sufficient. We assent to this doctrine.

The proofs submitted to us include decrees affirming these patents by Mr. Justice Gray, Mr. Justice Matthews, Judge Lowell, Judge Blatchford, Judge Wallace, Judge Nixon, Judge McKinnon, Judge Butler, Judge Nickerson, with opinions at more or less length by Mr. Justice Gray, Judge Lowell and Judge Wallace. It has been urged by the respondents that in all these causes save one there was either an absence of one or more of the defenses here urged or collusion between the parties and consequent imposition upon the courts, so that the decrees and decisions submitted and referred to above should not of themselves be the basis of the decision and decree here. In the Molecular case, decided by Judge Wallace last June, there has been no charge of collusion and consequent imposition. We think that these causes abundantly show that the substantial defenses here submitted have been urged in several of those cases (though perhaps they have not been urged with the vigor and persistence that have characterized the defense here), and that the settled practice in the Circuit Courts of the United States would authorize the granting of the injunction *pendente lite* upon the authority of the decrees in those cases. We do not understand that the weight given by one Circuit Court to the adjudications of another rests entirely upon the basis of comity, but as well upon that of recognized rights and of convenience, and that it is largely to prevent the necessity of more than one court going through with the investigation of the same facts that the inference desired by the first court is for the purpose of determining whether or not an injunction shall go till the final decree adopted by the other Circuit Courts. In addition to the weight to be given to the adjudications in favor of the Bell Company in other circuits on the basis of convenience, comity and recognized rights, it is urged that the National Improved Telephone Company, the principal defendant here, is estopped by the final decree rendered by Judge McKinnon in the Pittsburgh case because it was privy to that suit, and had a day in court there.

The evidence shows that the National Improved Telephone Company claiming to own certain patents pertaining to telephony was the licensor of the Pittsburgh company, and contracted for a consideration received that in case of any litigation involving the validity of said letters patent or any of them wherein the Pittsburgh Company should be a de-

fendent, the said National Improved Telephone Company should have prompt notice thereof and should assume control of said litigation, and at its option be made a party thereto at its own expense; that the Pittsburg suit did involve the validity of said letters patent, that the National Improved Telephone Company was promptly notified thereof and did assume control of the litigation, preparing an elaborate defense and appearing therein by counsel, who were heard by the court, and that becoming dissatisfied by the refusal of the court to go behind the decrees of other circuits in the matter of a preliminary injunction, the National Improved Telephone Company "ordered the immediate withdrawal from the court of all the evidence, instruments and documents of every character connected with the defense," and "immediately dismissed the counsel in said case."

In Robbins *vs.* Chicago, 4 Black, 657, it is said:

"Conclusive effect of judgments respecting the same cause of action and between the same parties rests upon the just and expedient axiom that it is for the interest of the community that a limit should be opposed to the continuance of litigation, and that the same cause of action should not be brought twice to a final determination.

"Parties in that connection include all who are directly interested in the subject matter and who had a right to make a defense, control the proceedings, examine and cross examine witnesses and appeal from the judgment.

"Persons not having those rights substantially are regarded as strangers to the cause, but all who are directly interested in the suit and have knowledge of its pendency and who refuse or neglect to appear and avail themselves of those rights are equally concluded by the proceedings."

See also Chicago *vs.* Robbins, 2 Black, 418.

To the same effect are Cromwell *vs.* County of Sac, 942, S. 351; Chamberlain *vs.* Preble, 11 Allen, 370; Treadwell *vs.* Sioux City, 39 Iowa, 663.

The rule is applied in patent cases. Robertson *vs.* Hill, 6 Fisk, 465; Miller *vs.* Liggett, 7 Fed. Rep. 19.

No authorities are cited to the contrary, but counsel have argued that the National Improved Telephone Company had a right to withdraw from the litigation, and that there upon, in some unaccountable way, the company was released from all responsibility, and that the complainant had no right to proceed to a decree.

We cannot avoid the conclusion that so far as the National Improved Telephone Company is concerned in this suit that it is bound and concluded by the final decree rendered at Pittsburgh, and that decree alone warrants the injunction *pendente lite* in this case as against said telephone company and its privies.

Since we have had the cause so exhaustively presented and we have so fully considered it, we have determined not to rest our conclusions upon the decrees in other other circuits, sufficient as we deem those to be, but to examine the questions *de novo*.

It is urged by the defense that there should be given a weight to the fact that the Executive Department of the Government has directed the institution of a suit to annul this patent that should lead us to refuse or deter any affirmation of the patentee's rights till the conclusion of that suit. To this we can not assent. The Executive Department has not in this case attempted to adjudicate rights, nor could it in any case do more than start the judicial inquiry and present the cause to the courts. The filing of an information cannot create a presumption of guilt. No more can the institution of a suit to annul create a presumption of nullity. If any effect is to be given to the pendency of this suit to annul so as to suspend any rights of the patentee it could only result from restraining or other orders issued in that suit, where the court having the parties and the evidence upon which the nullity is sought to be established before it has also the authority, if to annul them, to suspend the force of the patent.

There is a class of cases where the decisions of the Executive is conclusive upon the courts. This class includes only those which present political questions, such as, which is the lawful government in a State or in a foreign country?—questions connected with functions of sovereignty, where promptness and unity of action in all the departments of government are essential. All questions properly judicial are, by the very Constitution, embraced within the judicial power and submitted exclusively to the courts.

It is necessary to consider two grounds of the invalidity of the letters patent of Alexander Graham Bell.

No. 174,465, issued March 7, 1876, on application filed Feb. 14, 1876. 1. It is urged that after the filing of Bell's application his specifications and claim were changed in consequence of information derived through the examiner of the Patent Office from the caveat of Elisha Gray, filed on the same day with Bell's application.

We have reached the conclusion that the invention is set forth in the claim and specifications as originally filed, and that, therefore, any inquiry into this question would lead to nothing which could affect the validity of the patent.

It is overwhelmingly established that Bell made the affidavit to his claim and specifications as originally filed on the 20th day of January, and that Gray's description of his invention embodied in his caveat was not written out till three or four days prior to Feb. 14, when it was filed.

The fifth claim of Bell originally filed is as follows: "5. The method of, and apparatus for, transmitting vocal and other sounds telegraphically as herein described, by causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth."

In the specifications originally filed by Bell there is the figure and description and illustration of the apparatus and process.

Fig. 7. Another mode is shown in figure 7, whereby motion can be imparted to the armature by the human voice or by means of a musical instrument.

The armature *c*, Fig. 7, is fastened loosely by one extremity to the uncovered leg *d* of the electro-magnet *b*, and its other extremity is attached to the center of a stretched membrane, *a*. A cone, *A*, is used to converge sound-vibrations upon the membrane. When a sound is uttered on the cone, the membrane *a* is set in vibration, the armature *c* is forced to partake of the motion, and thus electrical undulations are created upon the circuit *E b e f g*. These undulations are similar in form to the air vibrations caused by the sound—that is, they are represented graphically by similar curves.

The undulatory current passing through the electro-magnet *f* influences its armature *h* to copy the motion of the armature *c*. A similar sound to that uttered into *A* is then heard to proceed from *L*.

To simplify: In the fifth claim and the part of the specification quoted above, the applicant declares that his invention consists in this: In the discovery that vocal or other sounds, by being uttered or otherwise communicated through a receiver, and by reason of their force being made to impinge upon an armature, impart to it the vibrations of the air; that these motions of the armature cause corresponding undulations in the electrical current, so that at the end of the circuit similar vibrations are given to another armature, through it to the surrounding air, and through the air to the human ear. Thus voice is communicated to the electrical current, and reproduced at the end of the wire in the air, and all this by reason of the discovered fact that vibrations in the air caused by sound are so similar to the undulations in the electrical current that vocal sound, of whatever character itself, may be passed from air to the electrical current, and delivered again through the air by means of receiving and a delivering or emitting armature.

The great discovered fact was that the vibrations in the air are similar in form to the following and imparted electrical undulations, and that the undulations are similar to the ultimate vibrations.

It follows that as are the vibrations so are the undulations, whether gradual or sudden, of whatever pitch or loudness, whether constant or varying in pitch or loudness, whether caused by a single or by successive sounds. We think this a sufficient description of the process and apparatus and of the whole discovery patented, and that it neither required nor did it require any substantial changes by the amendments subsequently made, no matter from what source suggested or desired.

Another objection urged by the defense was that the apparatus described in the specifications, and illustrated by Fig. 7, is not capable of transmitting articulate speech. There are affidavits to this effect, but the affidavits in favor of the capability are very strong and satisfactory, and the court itself through its own senses was convinced that the transmission of speech had been completely attained by means of the Bell apparatus, as exhibited by Fig. 7.

The fact that Bell's invention certainly dates from January 20, 1876, and that it covers a speaking telephone transmitting articulate speech by means of an undulatory, oscillatory or vibratory current of electricity, renders it unnecessary to pass upon the evidence relating to the tergiversations and claims of Gray; the alleged frauds of Bell in advancing his application for a patent, the illegal conduct and conflicting statements of Examiner Wilber, and many alleged vices and irregularities, the evidence of which forms the bulk of the record, and apparently the main defense in the case.

At the same time it is proper to say that in all the evidence we have found nothing that shows that Bell has done or caused to be done anything inconsistent with his right to be called an honest man, with clean hands.

If he availed himself of information derived from Wilber as to the contents of Gray's caveat, filed on the same day as his (Bell's) application [which, however, does not appear], he had a right to do so to enable him to restrict and limit and clearly define his application, as the information shown to have been furnished, was furnished under the authority of Rule 33 of the Patent Office for such purpose.

We will next consider the second ground of defense, which is that the invention of Bell lacked novelty, because it had been anticipated by Philip Reiss.

That Reiss made great strides toward the discovery of the great fact or law subsequently announced in the fifth claim of Bell does not admit of doubt.

That he failed to reach it is equally beyond question.

"It is impossible to transmit speech electrically by means of that operation, for the reproduction of articulation requires the reproduction not merely of the number of sonorous vibrations, but what is technically known as their form or character. The electrical changes on the line which are to convey this characteristic from that transmitter to the receiver cannot do that unless they take note of that characteristic and bear its impress. This is as certain as any elementary proposition of geometry."

Reiss apparently had no idea of operating through a continuous, uninterrupted current, which should be undulatory, *i. e.*, should be plastic, impressible and should be the medium of receiving freely and continuously and reproducing exactly the vibrations in the air, accompanying sound by the corresponding disturbances in the electrical current without any intermission of the flowing of the current.

Reiss discovered that by means of the electrical current sound could be received, transmitted and delivered. But it was the pitch of tones that was transmitted, and exclusively by means of an intermittent make and break current—a current incapable of conveying the form of sounds, protracted or varying sounds, and, therefore, incapacited to convey articulate speech. His apparatus appears to have been devised in the attempt to transmit speech by electricity, but the attempt was an acknowledged failure. His apparatus, under the influence of the voice or other sounds simply broke the circuit at each principal vibration with a frequency corresponding to the pitch of the sounds. Prof. Trowbridge says:

In the Jahresbericht, or the Annual Report of the Physical Society of Frankfort, for the year 1860-61, is an account given by Reiss himself of his invention and apparatus. It was presented to the court as translated in the biographical sketch of Philip Reiss, by Silvanus P. Thompson, published in London in 1883. Upon a suggestion that the translation might be imperfect, we ordered that the memoir be obtained from the Congressional Library, and should be translated into English by J. Hanno Deiler, Professor of German in the Tulane University. We have carefully compared Mr. Reiss' description of his invention and apparatus, as given in the two translations. While differing in the words used in the two renderings, they agree in making Reiss state that he uses an "intermittent current," and that each sound wave effects an opening and closing of the current." This is made even more palpable by his illustration of his apparatus or instrument. This is entirely inconsistent with any idea of a continuing current which should undulate, *i. e.*, be increased or diminished merely by an apparatus so constructed as to be susceptible of being set in motion by the vibrations of the air produced by sound, and should freely receive, convey and deliver single or successive sounds by reason of being so constructed as to be capable of being started and continued in motion just so long as the vibrations of the air lasted. He did not apply to his instrument to the law—indeed, he seems not to have designed his instrument with any reference to the law—that the vibrations in one medium had an exact correspondence to the undulations in the other, not only for an instant, but for any period of time.

The merit, and, as we think, the originality of the Bell invention consisted in the discovery of this law and in the construction of his apparatus so that when the sound caused aerial movements or vibrations they might, without any intermission of the current, be freely transferred or translated into electrical undulations which again, at the end of the circuit, would freely reproduce the aerial vibrations and thus convey, single or combined, transmitted sounds to the ear, and continue to convey them, without interruptions, as originally uttered, whether single, combined or successive.

A great fact in proof of the correctness of this deduction is, that the instruments invented by Reiss and his methods were described in many scientific papers and works, and were well known in the scientific world, and the instruments were manufactured and on sale in Paris, Vienna and Frankfort, and had been exhibited before the British Association, and a pair were deposited in the Smithsonian Institution, and yet before 1876 there was no speaking telephone in use, nor any pretense of any.

The various reproductions of Reiss and his methods all were based upon the same defective electrical means—an intermittent circuit-breaking current, and all were practical failures for the transmission of speech until Bell's method was discovered

From the evidence submitted in this case it seems clear that now, in the present state of the art, neither that Reiss' instruments nor any reproduction of them can be made to transmit articulate speech, except by changes of some form in the instruments themselves or by the employment of Bell's method.

We therefore conclude that neither Reiss nor his successors anticipated the invention of Bell as set forth in the fifth claim of his application and patent and as illustrated by Fig. 7, described in his accompanying specification.

The Meucci defense that is brought forward in defendants' record, taking up 120 printed pages, was abandoned by counsel on the hearing and no effort made to sustain it.

There remains, therefore, but the question of infringement.

This matter has not been squarely met by the defendants.

The complainants' bill alleges, and their experts testify in the opening papers, that the instruments used by the defendants consist of a microphone transmitter and a magneto receiver, which has been decided in the Spencer and Molecular cases to be an infringement.

The defendants in their answer (unsworn to) in a vague and argumentative way deny infringement

In their affidavits they do not attempt to show what they were using at the filing of the bill; but they allege in affidavits filed pending this motion, that "Defendants' apparatus, as now used, may be more particularly defined as operating in method or principle of operation under the Reiss inventions of 1860-4, and under special inventions patented by Randall, May 21, 1878, May 4, 1880, May 3, 1881," complainants having filed affidavits showing infringement in this apparatus now used. Leave was granted to defendants to file another affidavit stating fully what it is that defendants use. Under this leave an affidavit of C. A. Randall (the sixth in the record) has been filed, which contains much impertinent matter reflecting on counsel and opposing experts, but throws no direct light upon the matter, but from the affiant's argument we infer that he means to say that defendants are using the apparatus above referred to. The complainants urge, and their affidavits show, that the instruments of the Randall patents above referred to transmit speech by means of the Bell variations of current, and we are disposed to agree with them in this view.

Let the injunction issue,

DON A. PARDEE,
Circuit Judge,
EDWARD C. BILLINGS,
District Judge.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, JUNE 12, 1886.

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The Electrical Accumulator Company, of New York, have secured the services of Wm. B. Vansize, a patent attorney and electrical expert, for several years past in the employ of the Western Union Telegraph Company, and more recently with the American Bell Telephone Company, of Boston. Mr. Vansize is one of the most thorough and efficient patent attorneys in the electrical field, and the Accumulator Company are to be congratulated upon securing his services.

The New Orleans telephone decision sets at rest the false claim upon which the infringers have been building, viz., that the courts would grant no injunctions pending the Government suit. The fallacy of this claim is proven by this decision, to the consternation of the infringers.

We hope and expect that some one, some day, will invent an electric elevated railway system.

The Committee on Horse Railroads of the Massachusetts Legislature have given the petitioners for a charter for an elevated electric railway on the streets of Boston leave to withdraw. This decision to refuse the request of the various electric railway applicants was reached on listening to the very lucid and comprehensive review of the situation by that able electrical engineer and most excellent authority, Mr. C. J. H. Woodbury, of Boston. What he stated to the committee appears in full in this issue of the REVIEW, and is an unimpassioned and unprejudiced statement of existing and undisputable facts The remonstrants to the petition for the charter, represented by Mr. Woodbury, were the owners of $20,000,000 worth of real estate.

THE VALUE OF THE DISTRICT TELEGRAPH.

NEW HAVEN, CONN., June 1.—The night watchman at the brass and iron foundry at Shelton was assaulted by two men last night, who kicked and clubbed him until he became unconscious. The men went into the engine room and unscrewed the nuts and loosened the bolts in the boiler and engine. While they were at work the watchman recovered sufficiently to give an alarm, and the men were captured. They proved to be John Bristo and John Granger, two discharged employes.—*Press Dispatch.*

The outrageous assault upon the night watchman at a foundry in New Haven by two discharged employes, on the night of the 31st ult., was a serious affair which is liable to happen elsewhere, but further precautions can be taken in cities where a district telegraph can be connected to the various watchmen's stations upon the property, and his signals are transmitted to the central office. If there is the delay of fifteen minutes, a policeman is sent at once.

In an establishment in Brooklyn where this system is used, it was found that a delay was caused by the fact that the watchman had fallen in a fit, and would have probably died in half-an-hour but for the medical assistance summoned by the policeman.

In another instance, a watchman fell and met with a severe accident. This plan is superior to watchmen's electric clocks placed in the office of the corporation. The routes of watchmen ought to be laid out so that they will not consecutively patrol the same beat, but that one man will alternate with another.

ELECTRIC STREET CARS.

The report of the Jury on the Antwerp Exhibition awarding the medal of honor to the designer of an electrically actuated tram-car, has again turned public attention in that direction.

We have heard of several new companies having great expectations and have been told by each that "now they have it, and that we will see big things before long."

We have no reason to doubt their assertions. In fact, we have learned never to doubt anything "electrical." We are content to wait and be astonished.

The Antwerp device consists of an ordinary tram car, a motor and a set of twenty accumulator cells, so arranged as to be readily put into and taken out of the car. There is nothing specially new about the car, or the motor, or the batteries—all are of well-known types—although claims of special efficiency (nothing is said about patents) are made for the batteries. The merit, therefore, must lie in the relation of the several parts.

We have no doubt that street cars can be operated by means of accumulators, and economically. That they will be a vast improvement over "horse cars" goes without saying.

Heretofore the whole trouble has been with the accumulators. The recent tests in London and Antwerp, as well as in this country, show that they are not as black as painted and as worthless as the general public has been made to believe, or possibly that radical improvements have been made. So far as this country is concerned, the general opinion seems to prevail that, now that they have been taken up by men of acknowledged experience and ability, the progress to culture of "great things" is in a fair way to be realized, and that shortly.

THE PERILS OF UNDERGROUND WIRES.

"It is so much easier," said a gentleman the other day, when canvassing this underground wire problem, "to find fault with existing systems than it is to improve or even select some from the many that are offered."

True, every word, true. First there is the matter of insulation—that of the single wire—its insulation from its parallel neighbors, large or small; and finally the insulation of the whole from the earth, in which the total mass is to be buried.

This insulation must be of a nature to withstand all sorts of weather without deterioration—must be utterly and thoroughly damp-proof.

Next to such an insulation the all-important point is mechanical protection. The crowbar, the mattock and the spade—these are the natural enemies of the buried wires, and provision looking to protection from each and all of these must be made everywhere.

Experience shows that there can be made a wire insulation which will accomplish all that is required in the way of prevention of contacts, whether of contiguous wires or between these and the earth. Such an insulation, which has been thoroughly tested by time—the only true test for an insulator—exists in several forms of covered wire. This may be and is accomplished by the use of wires insulated with material which only remains an insulator when protected from contact with the atmosphere.

Protection from mechanical injury is not so easily accomplished. Iron boxes, iron pipes, sub-way conduits of whatever nature, in cities where gas, and water, and sewage systems are constantly being overhauled, from this standpoint are all about on par, and must all take their changes, in the struggle for underground existence.

The next great bugbear in the underground question, and one which is looked upon by many as the worst, is the possible damage a system is liable to from heating and other steam pipes, where these may come in close proximity to the conduit, pipe, duct, or what not, and the casual danger from an escaping jet of steam.

All of our metals of large commercial use are good conductors of heat, as well as of electricity. This means that they are ready absorbents of heat, when compared with such materials as asbestos, mineral wool, hair, wood, etc. This ready absorption of heat by the metal means a reduction of the heat of the steam, and the transmission of this heat to the wires, which the metal covering protects.

The mechanical and steam engineer, where pipes lead a considerable distance from the boiler, covers these with a coating which prevents the radiation of heat, and he is thus enabled to maintain his steam at a high pressure.

If this can be done successfully in the case of retaining the heat, why will not the same application prevent the penetration of outside heat? Experience has shown that this can readily be acccomplished. It is only a question of mechanical ingenuity and practice.

But there is an objection to an iron pipe, or an iron conduit, in its connection with the action of heat, which is more or less serious. Every time you go into the cellar and place your hand upon the gas or water pipe, in the warmest of weather, you discover that it is wet, and often, in winter, it is covered with frost. This condensation will occur inside as readily as outside of a pipe of iron or lead, or any other metal.

The expansion and contraction of an iron pipe, through the ordinary changes of temperature, will pull the joints apart and cause leaks at such places, through which all kinds of gases, water—and with it silt—will sepe through.

Ths lasting properties of iron pipe beneath the soil, too, are at least problematical.

What, then, can be used to good advantage? Wood? It affords too slight protection from mechanical injury. Stone—brick—concrete? All absorbents of moisture, and hence useless as insulators.

There seems but one substance against which the objections above cannot be charged. The material used in the Chicago system is not a ready absorbent of heat, and consequently requires a high heat for its reduction. It does not, for the same reason, contract or expand sufficiently to injure the joints. It is lasting That which was placed in Lincoln Park years ago for sewage purposes is to day more solid and compact than when first placed.

It will not succumb to heat in the ground, when properly placed, so as to injure the wires without its total destruction, and it may be protected by non-conducting covering, as readily as any other material of which pipes are made.

Neither water, nor gas, nor silt can be forced through this material, nor is it affected by weather. It can be moulded readily into any desired form, size or shape; and when an accident or necessity requires either mending or a change in a pipe or manhole which has been already placed, it can be done on the ground more readily than with any other material of which conduits have so far been constructed.

It is not claimed that this system is perfect, but that it stands in the front rank, and is far less liable to objections than other systems which have latterly come to the surface we think cannot be successfully controverted.

ELECTRICAL NEWS OF THE WEST.

The engine which runs the electric lights in the Court House was stopped on Saturday the 29th for repairs for several hours, and as there is no gas in the building some of the officers in the building enjoyed an enforced holiday, and saw the decoration procession. No damage was done, and little was thought of it, save by those who are representatives of other light companies.

Public telephones in Chicago are largely located in drug stores. Of course the clerk, if of the average accommodating disposition found behind the soap and perfumery counter, will do all the telephoning for the young and pretty customers from choice and for the old and deaf per force. A humorous description of the ins and outs of the public telephone complications got into print here the other day through a new clerk, who said:

The worst thing I have to get along with is the telephone. It's a public telephone, and it's the most overworked piece of mechanism you ever saw. The clapper has worn a hole in both bells, and there are gray whiskers on the transmitter. I never knew why they called 'em Bell telephones till I came over here. No woman that has ever been here has been able to talk through it without my aid. They make me a sort of go-between with their hubbies. Some of these days I'll be up as a witness in the divorce court if I ain't careful. The other day a woman came in and had me call up her husband. Then she asked me to say she wanted two seats for the "Black Hussar." She told me afterward that he brought home two sheets of tar paper, and she blamed me for the blunder. We're an agency too for one of the newspapers, and we have to telephone advertisements. Some Saturdays this place is so full of servant girls looking for a place that it appears like an intelligence office. There, hang that telephone, excuse me—Hello! etc.

Dakota is a lively infant, and though of immature age, is quite a vigorous kicker. So far she usually kicks in the right direction. The last kick, in the line of electrical matters, comes from a "Deadwoodite," who claims that a recent publication stating that Aberdeen and Fargo are the only towns in Dakota lighted by electricity is way off. He desires to notify the REVIEW that Deadwood and Lead City have used electricity that way for three years, and thinks that Sioux Falls has also used the same light for some time.

That affidavit of Zenas Fisk Wilber, which it was hoped would be booked as first-class evidence, having been ruled out, supplemented by Bell's rejoinder, with its plain and

unmistakable frankness, produced an effect which was hardly anticipated by the enemies of the Bell Company. Metaphorically speaking the various Tichbornes in the case were as completely nonplussed as the Scotch gillie in the play who heard a remark which was quite strange to his vocabulary, and who immediately fell weeping upon the neck of his intended's mother, and exclaimed, his voice choked and damp, "Ah! mither, mither, there's bin a misoonderstawndin', a misoonderstawndin', mither."

Hardly had these parties recovered their wonted equanimity, and turned toward the South for consolation, when Judges Pardee and Billings, of the United States Circuit Court, in session at New Orleans, rendered a decision in the case of the American Bell against the International Improved Company, ordering the injunction to issue against the defendant.

The case has occupied the time of the courts for several weeks in the argument. In summing up, the judges call attention to the fact, that the "instruments invented by Reiss, and his methods, were described in many scientific papers and works, and were well-known in the scientific world, and the instruments were manufactured and on sale in Paris, Vienna and Frankfort, and had been exhibited before the British Association, and a pair were deposited in the Smithsonian Institution, and yet, before 1876 there was no speaking telephone in use, nor any pretense of any.

"The unsworn defendants in their answer in a vague and argumentative way deny infringement. In their affidavit they do not attempt to show what they were using at the filing of the bill, but they allege in affidavits filed pending this motion, that the defendants' apparatus as now used may be more particularly defined as operating in method or principle of operation under the Reiss inventions of 1860 to 1864, and under special inventions patented by Randall, May 21, 1878, May 3, 1881."

The underpinning of the entire fabric, reared on sand, has thus been washed away. The demand that injunctions should not issue against infringers, simply because it was assumed that the Bell patents were obtained through fraud, or otherwise illegally granted —not that this was proven—which was the hope, end, and aim of the enemy, and which has here been denied, virtually stops the trespassers as effectually as a barb-wire fence stays a herd of roaming cattle.

And there are people who have listened to the blandishments of dealers and have purchased shares of sundry and divers outside stocks, in times gone by, which gave fruitful promise, but which in the future will be pigeonholed in loving fraternity with shares in deceased silver and copper speculations, under the comprehensive epitaph "Gone, but not forgotten. Once a love—now a memory." And as these shall accumulate the dust of growing years, the text will still continue to ring in their ears, in obedience to that universal law of vibration by which the telephone accomplishes its destiny, There's bin a misoonderstawndin'.

Judge Gresham on the 1st instant overruled the motion for injunction in the case of the Western Union against the town of Moline, restraining the latter from interfering with its wires, and dissolved the temporary injunction heretofore existing.

This case was one in which the telegraph company had three wires on Fifteenth street, which, when these were placed, was not within the city proper. The city this spring gave the Merchants' Electric Light Company the right to use the streets and alleys of the city, for a plant of seventy-six lights. Fifteenth street, which is now in the city, became the battle ground, and the telegraph company obtained a temporary injunction, charging that the city and the electric light people had conspired to force an abandonment of its rights along the route in dispute.

In Youngstown, Ohio, the status of things is reversed. The Central Union Telephone Company has obtained an injunction against the local electric light company there, which restrains the latter from so placing their wires as to work damage or danger to the property or persons of the telephone company. The Central Union people have been unfortunate through neighboring with these giants of electricity. Their offices at Dayton and Toledo have been partially wrecked through contact between telephone and electric light wires, and occasional scorchings have occurred elsewhere.

New Orleans is soon to have police telephone and signal service, and the council committee has decided upon the location of the street boxes, 100 in number, distributed through eight precincts, with three headquarters stations.

Cheltenham Beach, a summer resort, on the lake shore, about seven miles south by rail, is to be lighted by electricity at once. The contract has been secured by the Fort Wayne Jenney people here, for 130 arc lights and 250 incandescent. The plant is to be running by July 3d. The Jenney people have also recently sold a 60-arc light plant to the gas company at Batavia, N. Y.

Some one is gathering opinions on the subject of wire gauges. The question being before the people, remarks are in order. Since there are so many, and various and irregular gauges, how would it do to drop the numbers entirely, and say how many milimeters diameter? Or if that is too much, what is the matter with giving the metal and weight per mile, or meter, or some fraction of these? While we are about it why not drop everything in the way of measuring except the metrical standards, and forget that three grains of barley make an inch, or that the French foot, which was materially shorter than the third of a yard, was the exact length of the pedal extremity of one of the early French monarchs. Ordering a No. 23 wire for instance to-day, one should specify—if exactness is vital—whether it is No. 23 of Brown & Sharp, or London, or Stubbs, or the last craze in this direction, the new British? Let us have one or two more gauges, and then go by sizes or weight. By the way, what sense is there in commencing with a lot of zeros for the largest wires, and working backward until the finest wire is the highest number? Wouldn't it make the muddle more complex if somebody would commence with the finest wire and number the other way, and so bring the whole thing to an end quicker.

Every now and again we see in the newspapers a picture of a party in scanty garments with a pair of bellows in his hands firing away for dear life at all sorts of nondescript things all wings and legs. Every time one of these appears I think of the induction killers. The phrenomenotechny which brings this about is that induction is a bug, and the induction killer is a bug killer. The chap with the powder gun kills his bugs for good and all. The induction killer's bug has, so to speak, a soul, according to the conservation of energy, religion, and just so soon as he ceases to exist as induction he blossoms out as a new being, and is called retardation. As in mechanics, you can neither create nor destroy, so in electricity, the force is there, all the time—immortal.

"You may break, you may shatter the vase, if you will,"
But the scent of the roses will cling to it still,"

or words to that effect. Ask the telephone people for further particulars.

Col. S. G. Lynch, broker, at 146 La Salle street, gives the following telephone stock values.

Chicago	$350 @	$360
Central Union	43 @	45
Michigan	63 @	66
Iowa Union	15 @	18
Great Southern	25 @	27
Great Southern, Script, 90 cents on the dollar.		
Colorado	18 @	20
Rocky Mountain Bell	40 @	45
Missouri and Kansas	54 @	56
Missouri and Kansas, Script, 53 cents on the dollar.		
United	15 @	17
Cumberland	65 @	70
Wisconsin	101 @	106
Bell of Missouri	147 @	150

CHICAGO, June 7, 1886.

BOSTON ELECTRICAL NEWS.

The adoption of the incandescent light in houses removed from central stations has been prevented for the want of a suitable dynamo and motive power. The Household Electric Light Company have at their factory, 153 Essex street, Boston, a complete installation in working order. The engine is automatic, the governor regulating the cut-off, and the speed is practically constant under varying loads. The water in the boiler is maintained at the level by a pump, which forces water when the level is below the line for which the float is adjusted. The fuel used is kerosene of 110° test, which is carried in by a jet of steam, the feeding of the oil being cut off when the gauge reaches 110 lbs. pressure to the square inch. The engine is almost noiseless, and when supplied with oil and water runs without attendance. Nearly all the bearings are enclosed in an iron case, partly filled with oil, so that a hot bearing is unlikely to occur. To develop one horse-power (sufficient for eight 16 candle-power lamps), somewhat less than half a gallon of oil per hour is consumed. The cost is therefore much less than gas, and doubtless many installations will be made. The dynamo is self-regulating, and requires no attention when lights are turned on or off. No special training is required to manage the plant. The lights are run at full candle-power, and are remarkably steady.

At the graduation exercises of the Massachusetts Institution of Technology, June 1, fifty nine persons received the degree of B.S., ten of the number in the department of electrical engineering. Of the selection of the abstracts of theses read, a number were given on electrical subjects. W. L. Church, B.S., described tests with a 60-light 16 candle-power Weston machine, with a view of determining the variation of electro-motive force with different current strengths. In studying the distribution of potential around the commutator, a pair of copper brushes separated the distance of one commutator; segments were used, the wires being connected to a Thompson potential galvanometer.

T. Stebbins gave results of experiments with a view of determining the possibility of ocean cable telephony. Retardation with Morse instruments is noticed in lines over 200 miles long, and is more marked when the whole or any part of the line is underground. The law is that the retardation is a function of the resistance and the electrostatic capacity can be used in calculation. An artificial cable was used consisting of 80 condensers and variable resistances. The insulation resistance of the condensers could be varied from 100 megohms to 100 ohms. It was found that with the Blake transmitter and Bell receiver speech could be heard through a line having an electrostatic capacity of 3,000 microfarad ohms, with long-distance transmitter, through four times this amount. The results show that underground systems are possible as far as distinctness is concerned. Other papers read by title were: The Electrical Transmission of Power, D. P. Bartlett and H E. H. Clifford; Compound Winding of Dynamos, F. H. Crane; Tests of a Commercial Storage Battery, E. E. Higgins; Measurement of the Strength of Telephone Currents, with some Special Experiments in Blake Contacts, W. J. Hopkins.

On the inverse electromotive force of the voltaic art, W. E. Shepard gave the result of his experiments. It is somewhat difficult to arrange proper apparatus for producing the arc light in a vacuum. By striking the bulb of a broken incandescent lamp, the filament is set in vibration, and contact is made; at the point of breakage a small arc light is formed.

There has been in the last ten years no less change in electrical nomenclature than progress in the science itself. Positive and negative, as applied to electricity, have, to a great extent, gone out of use. Those who think electricity is a substance call the current the "juice." That dynamo and battery currents are different in quality, and that the so called static electricity is in a general way essentially different, are misconceptions soon to go out of use

Hihktros, of Dunamopolis, gave his whole time to the elevation of his fellow men. When he had assisted in founding asylums for many classes of unfortunates, he turned his attention to the amelioration of the lazy. It was discovered at the very beginning of the science of electricity that an electric current contracted a muscle when passing through it, and so caused motion. Research has shown that it is by currents of electricity generated in the base of the brain or the spinal cord that all muscular action is caused, and, consequently, work is performed. He found that those who are constitutionally tired suffered merely from a lack of electro-generative capacity. By the application of the terminals of a small induction coil, suitable muscular action could be caused. Our ancient friend came to an untimely end. He was experimenting on one of the rear extensor muscles of a mule, when an unusual amount of current acting caused a contraction which sent him flying in the air. He did not recover, and great was the loss.

The man who explained the red paint on a dynamo by saying that it toned down the bluish color of the arc lights has been outdone by an inquirer into the realms of electricity who asked what was the sympathy of a certain dynamo. The amount of sympathy expressed for the questioner, who had mixed up sympathy and efficiency, was affecting.

A leading electrical house in the West writes to the Chemical Electric Light and Power Company: "We are making a trial of Volta Pavia in electric lighting, electric motor work and general experimental apparatus, and the results obtained by our electrician are even better than those you advertise." The company are now beginning to hear the results of tests in different parts of the country, and will be able to furnish references in various classes of work.

BOSTON, Mass., June 8.

The Electric Club.

The Electric Club met at their rooms in the Hotel Dam, Thursday evening June 3d, and dined together informally. Subsequently at the meeting of the Board of Managers, the names of applicants for membership were presented, and Messrs. L. E. Curtis, Parker W. Page, Geo. H. Benjamin, Henry W. Pope, Samuel Insull, T. B. Doolittle, Loren N. Downs, and Henry A. Reed, were elected resident members; and J. F. Morrison, Baltimore; A. J. DeCamp, Philadelphia, and Gardiner C. Sims, Providence, were elected non-resident members. Mr. T. A. Edison was elected vice-president of the club, and Dr. Geo. H. Benjamin elected member of the Board of Managers.

French's Hotel, F. W. Coleman & Co., proprietors, was selected as the down town annex where members will have the exclusive use, from 12 to 3 P. M. each week day, of two dining parlors for lunching together. A house committee consisting of five members was appointed, the names of fourteen new applicants for membership were posted in accordance with the by-laws of the club, and the meeting adjourned to July 1st.

There are two roads to fame to which a genuine Frenchman aspires, and which he considers almost too good for foreigners—the Academy and the Legion of Honor. Several Americans have been made members of the latter organization—notably Bell, Edison and Gray, in honor of their electrical investigations. Latterly, Dr. Cornelius Herz, who is an American born, was on the recommendation of the Minister of Posts and Telegraphs of the Republic, raised to the rank of Grand Officer of the legion, and he is the first and only foreign civilian who has been accorded this honor. Dr. Herz also has the order of St. Michael, which stands next in antiquity to the Golden Fleece. The doctor's honors commenced in 1870, when the Government entrusted him with its field telegraphy. He is known to every American electrician as the director or head of *La Lumiere Electrique.*

Telephonic News

⁂ N. A. Tanner, of New Haven, has patented a funnel-shaped attachment for focussing sound waves upon the center of telephone transmitters. There are quite a number of these so called aids to telephone conversations.

⁂ The fireworks committee, of the Albany Council, met the other night, and were proceeding vigorously with their work when a telephone message came from the chairman ordering an adjournment. The committee dispersed, but several of them expressed their indignation over the fact that they had been "adjourned by telephone." This instrument is no respecter of persons—not even of Albany aldermen.

⁂ The Hudson River Telephone Company is extending its line from Middletown via Howell's Depot, to Bloomingburgh and other Sullivan County points. Two wealthy gentlemen residing near Bloomingburgh object to having unsightly poles in front of their villas. They have warned the company not to erect them, and have taken out warrants for the arrest of the linemen for trespass in digging holes for the posts.

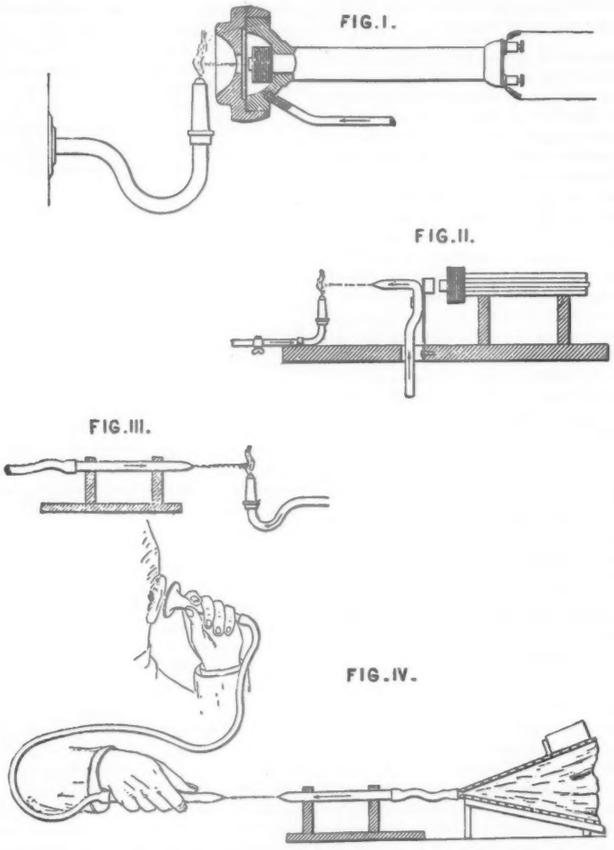
⁂ A dispatch from Chicago, June 5, says: "The Hon. R. P. Flower, President of the Electrical Subway Commission, has been here engaged in investigating the underground systems for electric wires now in operation in this city. Mr. Flower has inspected the Conduits of the Postal Telegraph and Western Union Telegraph companies, as well as the Dorsett conduits, in which the wires of the various city departments are carried, and has conversed on the subject connected with the work of his commission with many of our leading electricians and managers of telegraph and telephone companies."

⁂ A new firm of patent attorneys, whose specialty is securing patents for electrical inventions, has been formed by Messrs. Albert C. and Chas. D. Fowler, with offices in New York and Washington. These gentlemen are familiar with this branch of the legal profession, Mr. A. C. Fowler being particularly adapted for handling electrical causes, having been an examiner in the Interference and Electrical Divisions of the Patent Office from 1880 to 1886, and on resigning last January received a letter from Commissioner Montgomery commending his work in the department and regretting his departure.

⁂ The American Telephone and Telegraph Company's ordinance, favorably recommended by the committee of the Philadelphia Council, authorizes the company to lay and maintain underground telegraph and telephone wires, cables, and conduits under the following streets: From Ridgway pier, No. 7, on the Delaware, crossing Delaware avenue to Ton alley, to Water street, along Water street to Walnut, out Walnut to Fourth, on Fourth from Pine to Callowhill; from the intersection of Fourth and Walnut streets, out Walnut to Fifteenth street, up Fifteenth street to Chestnut, out Chestnut to Thirty-second, up Thirty-second to Market, out Market to Lancaster avenue, and out Lancaster avenue to the city line; from the intersection of Market street and Woodlands avenue, out Woodslands avenue to Baltimore avenue, and out Baltimore avenue to the city line. The crossing of the Schuylkill river is made subject to the direction of the Board of Highway Supervisors. Privilege of connecting with public or private buildings is granted, with a restriction to two openings in any one square. It is also conditioned in the bill that all official messages shall be forwarded free of charge, and three wires shall be furnished free of charge to the city for the use of the Electrical Department.

The New Invention of C. A. Bell.

The figures on pages 6 and 7 illustrate some of the discoveries of Chichester A. Bell, cousin of Professor A. G. Bell, the telephone inventor. Under the title of "Sympathetic Vibration of Jets," Mr. Bell, in a paper read before the Royal Society, states that his attention was directed to the subject by the accidental observation that a pulsating air jet directed against a flame caused the latter to emit a musical sound. The pitch of this sound depended solely on the rapidity of the jet pulsations, but its intensity was found to increase in a remarkable way with the distance of the flame from the orifice. In order to study the phenomenon, air was allowed to escape against the flame from a small orifice in the diaphragm of an ordinary telephone, the chamber behind the diaphragm being placed in communication with a reservoir of air under gentle pressure (Fig. 1). Vibratory motions being then excited in the diaphragm, by means of a battery and a microphone or rheotome in a distant apartment, the discovery was made that speech as well as musical and other sounds could be quite loudly reproduced from the flame. Certain observations led the author to suspect that motion of the orifice, rather than compression of the air in the chamber, was the chief agent in the phenomenon; and, in fact, precisely similar results were obtained when a light glass jet tube was cemented to a soft iron armature, mounted on a spring in front of the telephone magnet (Fig. 2).



SERIES 1.—ILLUSTRATING CHICHESTER A. BELL'S DISCOVERIES RELATING TO THE VIBRATION OF JETS.

Experiment also showed that an air-jet at suitable pressure directed against a flame repeats all sounds or words uttered in the neighborhood (Fig. 3). Except, however, where the impressed vibrations do not differ widely in pitch from the normal vibrations of the jet (discovered by Sondhauss and Masson), these effects are likely to escape notice owing to the inability of the ear to distinguish between the disturbing sounds and their echo-like reproduction from the flome.

In these experiments the primary action of the impressed vibrations was undoubtedly exerted on the air-jet; but a singular and perplexing fact was that no sound, or at best very faint sounds, could be heard from the latter when the flame was removed, and the ear, or the end of a wide tube connected with the ear, was substituted for it. Suspecting, finally, that the changes in the jet, effective in producing sound from the flame, must be relative changes of different parts of it, the author was led to try a very small hearing-orifice, about as large as the jet-orifice (Fig. 4.) The results were most striking. By introducing this little hearing-orifice into the path of a vibrating air-jet, the vibrations can be heard over a very wide area. Close to the jet-orifice they are so faint as to be scarcely audible; but they increase in intensity in a remarkable way as the hearing-orifice is moved away along the axis of the jet, and reach their maximum at a certain distance. Experiments with smoked air showed that this point of maximum sound is that at which the jet loses its rod-like character, and expands rapidly; it has been named the "breaking-point," because just beyond it the sounds heard from the jet acquire a broken or rattling character, and at a greater distance are completely lost. The distance of the breaking-point from the orifice diminishes as the intensity of the disturbing vibrations is increased, and also depends to some extent on their pitch and on the velocity of the jet. With orifices of from 1 to 1 5 mm. in diameter, it usually varies from 1 to 6 cm. The vibrations of an air-jet may also be heard at points not situated on the axis; but they are always most intense along the axis, and become rapidly fainter as the distance from it increases.

When a vibrating air-jet plays against a small flame, the best sounds are heard when the stream strikes the flame just below the apex of the blue zone. At the flame of contact an intensely blue flame ring appears, and this ring vibrates visibly when the jet is disturbed. The production of sound from it doubtless depends on changes in the rate of the combustion of the gas. This may be proved by inserting into the ring a fine slip of platinum, connected in circuit with a battery and telephone shown in Fig. 5. When the jet is thrown into vibration the consequent variations in the temperature of the platinum affect its conductivity, and hence a feeble reproduction of the jet vibration may be heard in the telephone.

In order to assist the action of aerial sound waves on the fluid it is advisable to attach the jet-tube rigidly to a pine sound-board about three-eighths of an inch thick. The surfaces of the board should be free, otherwise it may be supported in any way. The receiving membrane is formed by a piece of thin sheet rubber tied over the end of a brass tube about three-eighths of an inch in internal diameter. A wide flexible hearing tube, furnished with an ear-piece, is attached to the brass tube. The jet-tube is connected with an elevated reservoir by an India-rubber pipe, indicated in Fig. 6, with an apparatus of this kind and a tolerably wide jet-tube, having an orifice about 0.7 mm. in diameter, a pressure of about 15 decimeters of water is required to bring the jet into condition to respond to all the tones and overtones of the speaking voice (except hissing sounds) and those employed in music. At a somewhat higher pressure it will reproduce hissing sounds.

To get an accurate and faithful reproduction of the jet-vibrations it is simply necessary to insert into the nappe two platinum electrodes in circuit with a telephone and a battery having an electro-motive force of from 12 to 30 volts. Loud sounds can thus be obtained from a jet which is finer than the finest needle, and the arrangement constitutes a highly sensitive "transmitter," shown in Figs. 7 and 8.

The foregoing is little more than the outlines of a new theory of jet-vibrations. The author hopes to supply in the future further experimental evidence in support of it.

⁂ The plea of jurisdiction filed at Columbus, Ohio, sets forth the facts that the American Bell Telephone Company is a non-resident of Ohio, and that they are not connected with the other party defendants.

⁂ At the conference between Allen G. Thurman, the Hon. Jeff. Chandler and District Attorney Kumler in regard to the Pan-Electric case, it was resolved to send for ex-Senator J. E. McDonald, of Indiana, and other lawyers in the case, that a further consultation may be held. The attorneys expect to agree upon and ask the court to fix a day for the preliminary hearing. There seems to be a prospect now that an early hearing of the case will be decided upon.

⁂ The eruption of Mount Etna is declared to be the most sudden and terrible ever beheld by the inhabitants of the surrounding country. Eleven craters are active. The central one disgorges only smoke and ashes, but from three others huge stones are thrown up a prodigious height. The lava streams in some parts are 600 feet wide, and are flowing down the mountain side and through the fertile valleys, destroying the crops and setting the woods on fire. No lives seem to have been lost, but numbers of people are homeless, the earthquake shocks having destroyed their houses, or the showers of ashes and lapilli having obliged them to seek a refuge elsewhere.

⁂ Says the Indianapolis *Journal*, in view of the New Orleans decision: "We presume, of course, that the charge will be made that Judges Billings and Pardee are Bell organs; but the fact remains that the courts have uniformly upheld the Bell patents, and it is the fact with which people have to deal. Indianapolis and its Council can trifle and humbug as much as they please, but the fact remains that no telephone will be allowed to be operated here without the consent of the Bell people. If the city wants telephone service, that is one thing; if they want to have the Council pass ordinances for fun, that is quite another. The telephone is a monopoly—a miserable, bloated monopoly—but so are all valuable patents. The simple, plain question for all reasonable, honest, candid people to decide is, whether Indianapolis is to have any kind of telephone service, and that question the Council has not yet concluded to seriously consider."

The President's Telephone Suit.

The decision of the United States Court for the Fifth Judicial Circuit, which was delivered in New Orleans on Monday by Judge Pardee and Judge Billings, is a pretty hard blow for the telephone speculators and the shrieking maniacs, says the New York *Sun*, under the above heading, who sustain with all their power of vociferation the absurd and dangerous policy which has engaged the President of the United States as a party to a private patent suit.

In this New Orleans case, the hearing lasted for several months, and every point which had been urged or which could be urged against the Bell patents, was presented with all possible force and urgency. Not a single consideration which can be adduced in the so-called Government suit which is to be prosecuted before Judge Jackson in the Sixth Circuit, was omitted at New Orleans. It is true that these points and considerations were none of them novel. They had all been argued over and over again, with only a single exception in the numerous suits concerning these patents. This exception consists in the fact that the President of the United States has now undertaken to prosecute one side of this controversy, though in so doing he has no new evidence and no new principle of law to offer, but can only grind over again the old grist which has already been ground so often. Yet the fact that this high functionary of the Government has been induced, no matter by what influences, to make himself a party to this private lawsuit, was held up to the Judges in New Orleans as a consideration which should lead them to pause in the administration of the law, and to wait until the effect of the President's interference can be seen in the court of the new Judge whom he has just appointed in the Sixth Circuit.

To this proposition, however, the New Orleans Judges turned a deaf ear, preferring to decide the questions presented to them according to the law and the facts.

The public will not fail to notice that this decision is entirely in accord with all the decisions that have so far been made by the courts of the United States in this famous matter. The Bell patents are sustained, and all the attempts to overthrow them are pronounced here, as they have been pronounced elsewhere, to be unsound and void.

It might be supposed that the President of the United States would take warning from the rebuke thus administered, but there appears to be no reason for expecting that such will be the case.

The Indiana Telephone Work.

The excellent business tact of President Geo. L. Phillips, of the Central Union Telephone Company, has so changed the state of affairs in telephonic circles in Indiana that trouble there seems at an end. In the work of properly informing the citizens and convincing them of the injustice done by the passage of the law reducing rates, he has been greatly assisted by Superintendent J. E. Hockett, in charge of the Indiana territory of the company, and to-day, through the energy and common-sense methods of these gentlemen, the feeling has changed in favor of the company, and their proposition to furnish telephonic service under the toll system, until the law is repealed, is being generally adopted. Terre Haute is one of the most recent cities to agree to this plan. In an interview, President Phillips said:

"When the Central Union Company stated, after the passage of the Indiana law fixing the price of telephone service at $2.50 and $3 per month, that if it was compelled to accept that price or nothing, it would prefer to take nothing and would certainly withdraw from the State, it meant what it said, and it has not since changed its mind. I am in possession of all the figures, and I know that at the rental we are required to pay to the Bell Company the service costs us more than we would receive under the legal rate and would make money by discontinuing business in the State. What we have to offer is in view of the fact that the people of Indiana, many of whom will work for the repeal of the telephone law next winter, will be deprived of the use of the telephone in case we withdraw, as the Bell Company will prosecute every other company which introduces an infringing patent. They are all infringements, you may depend upon it, on the Bell. To bridge over this interval we will endeavor to meet the people of Indiana half way. Since we cannot afford to rent telephones for $2.50 and $3 per month and cannot legally collect more until the law is repealed, we will cease to rent telephones at all during the interval, but will make agents of such who wish to retain telephones in their places of business. Every connection will be charged for to the agent from whose office it is sent, who is to collect 5 cents for each connection made by outsiders. An account of every connection made on the call of any agent will be kept, and 5 cents for each one charged subject to this commission.

FIG. V.

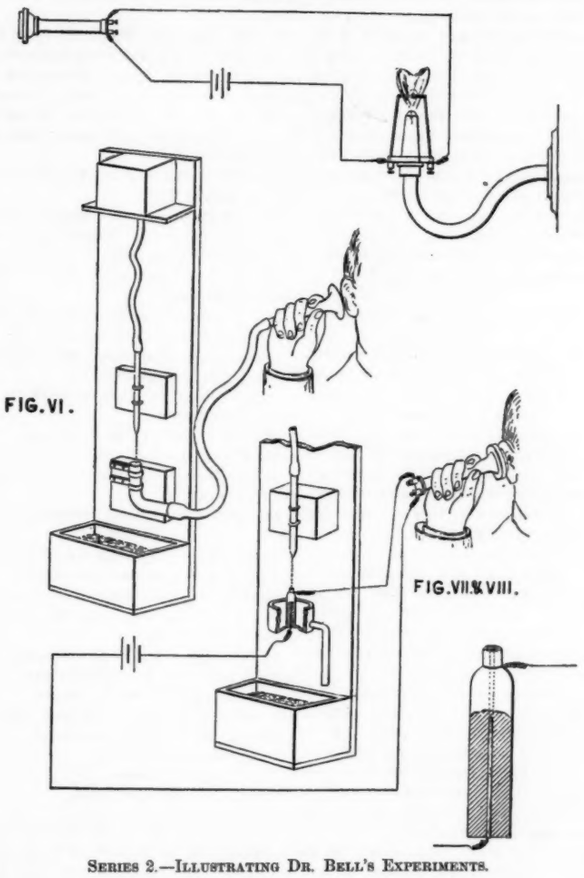


FIG. VI.

FIG. VII. & VIII.

SERIES 2.—ILLUSTRATING DR. BELL'S EXPERIMENTS.

"The first 50 connections in a calendar month, no per cent. commission.

"The next 100 connections in a calendar month, 50 per cent. commission.

"The next 300 connections in a calendar month, 75 per cent. commission.

"The next 500 connections (and over) in a calendar month, 80 per cent. commission.

"No commission is allowed on receipts for business going over the extra-territorial lines. Connections are charged to the office from which the call is sent. No charge is made against the office called up. The Central Union Telephone Company reserves the right to terminate the agency at any time, should it fail to be remunerative or satisfactory, but otherwise the agreement is to be in force and effect for the term of six months from date of signature, and thereafter until the party of either part shall have given the party of the other part thirty days' written notice of his or its desire to discontinue the same.

.... The twenty-sixth annual meeting of the Massachusetts Electric Medical Society was held in Boston June 3, and officers elected as follows: President, F. L. Gerald, M.D., of Laconia; vice-president, R. A. Reed, M.D., of Newton; corresponding secretary, J. B. M. Dickens, of Newburyport; recording secretary, B. H. Burrill, M.D., of Boston Highlands.

A Good Point for Receiver Farnsworth in His Suit for $2,000,000.

The most important evidence given in the suit of Gen. Farnsworth, receiver of the Bankers and Merchants' Telegraph Company, for $2,000,000 damages against the Western Union, was by Walter B. Phillips, manager of the United Press Association. Strenuous objections were made when Mr. Lauterbach asked him if he had received any information that the seizure of the Bankers and Merchants' wires was to be made. Manager Phillips said he was told by Wm. B. Somerville, superintendent of the transmission of press despatches of the Western Union Company. Mr. Choate and Judge Dillon contended that he could not testify if he never had seen a written order or heard verbal instructions given Supt. Somerville by the Western Union Company. After quibbling for some time Judge Lawrence asked the witness if he knew that Mr. Somerville occupied the position described.

"I know it as well as I know anything," said Manager Phillips. He explained that he had made contracts with Somerville, and talked over business matters with him. Then he was permitted to answer. He said in substance:

"From time to time after the failure of Mr Dimmock, of the Bankers and Merchants' Company, I talked to Mr. Somerville about the prospect of my making arrangements with the Western Union if anything happened to the Bankers and Merchants'. He had been my predecessor in the United Press Association, and was very friendly to me. He had told me that the Western Union was likely to get hold of the American Rapid wires, and I asked him to let me know in advance when they were likely to take them so that I could make some arrangement for my business. On July 10, 1885, about 2 o'clock, more than an hour and a-half before the cutting of the wires, Mr. Somerville came to my office. He said he had come to tell me privately that he was satisfied that the Western Union was likely to take the American Rapid wires. I asked him when it would be done, and he said: 'I think to-day.'"

This was regarded as a good point for the Bankers and Merchants', because it showed that, while it was known by the Western Union officials that an order would be made for the American Rapid property to be turned over, no notice was given to the Bankers and Merchants' so that they might make provision for carrying out the order.

TELEGRAPHIC

.... The wires of the Great Northwestern and Canadian Pacific Telegraph will soon be ready for business. A large number of poles, 130 feet high, have been erected in Montreal.

.... On Thursday evening, at 5.30, lightning struck the Western Union telegraph office at Clinton Corners, on the line of the P. H. and B. R. R., and damaged the wires and building to some extent. The fire was extinguished by the operator, Charles Hicks.

.... The Washington Commissioners have granted permission to the Western Union Telegraph Company, on certain conditions, to erect a line of poles on G street, between Seventh and Fifteenth streets, using the north side of G street from Fifteenth to Ninth street, and the south side from Ninth to Seventh street.

.... At the Russell Car Wheel Foundry, Detroit, is to be seen an immense coil of copper wire, which is wound on a reel seven feet in diameter. The wire is thirty-one sixty-fourths of an inch in diameter and is one continuous piece, 11,000 feet in length. It cost $1,100. It is to be used on the Dix avenue electric railway.

.... A summary of the working of the Government wires of Italy in 1885 has been issued from the General Telegraph Department. The private telegrams transmitted in the interior amounted to 5,896,306, showing an increase of 244,028 compared with 1884, and the messages for abroad, 581,657, or an increase of 13,386 on 1884. The Government and service telegrams were 664,358. The number of telegrams received from abroad was 687,423, showing an increase of 22,922. The gross receipts are set down at 13,694,194 lire, say, £547,770, and the expenditure at 10,952,048 lire, say, £438,080. The total length of the lines on 31st December last was 30,021 kilometers—an increase of 833 kilos. The length of telegraphic wire was 106,755 kilometers.

... Mr. W. Gemmill, an Englishman, has patented a "system of photo-telegraphy" in which selenium is utilized in order that a picture may be photographed at a distance through the medium of telegraphic wires. The arrangement acts by conveying an electric current that has passed through a selenium cell, varying in electromotive force as more or less light falls on the cell, to the receiving station, where it excites an electro-magnet, which, by its attraction on a series of switches having graded spring recoil, does by them switch on or off a greater or less number of subsidiary currents to an incandescent electric lamp. Every apparent point of light of a particular intensity in the image to be sent would, on being projected on to the selenium cell, cause the lamp to give a corresponding light, which, focussed to a point on the receiving plate, would represent that in the despatch, but far outrivalling it in brilliancy.

.... In his examination in the case now on trial, General Manager Jones said that the Bankers' and Merchants' Company was in a rather poor condition until it was taken hold of by Receiver Farnsworth, who immediately set about to improve the system. All the money he received, through receiver's certificates and otherwise, was used by the receiver for the purpose of improving the condition of the company and perfecting the property. There was then a constant improvement, which continued up to the time the Western Union seized the wires. "Is it true," asked the ex-Senator, "that a new company ever makes money from the start, or is there an interval during which time it loses money?" "Taking the most successful company as an example," replied Mr. Jones, "I believe the Western Union didn't pay dividends for a long time." "Make your answer a little more definite," insisted Mr. Conkling. "For some years," replied the witness. Mr. Jones said that the wires of the Western Union Company, mile by mile, could not be compared with those of the Bankers and Merchants' in many instances, because the wires of the former company had, to a considerable extent, been taken from other companies.

ELECTRICAL AND SCIENTIFIC

* * A Washington telegraph operator is now out of work. He saved one of President Cleveland's telegrams to his present wife, for the sake of the autograph, and through this the secret of the engagement is said to have leaked. The operator was promptly discharged.

* * The Manufacturers' Natural Gas Company struck a well with a tremendous pressure at Canonsburg, Pa. During a storm a short time later the gas was ignited by lightning and the derrick and rigging were entirely consumed. The well burned furiously.

* * M. Pasteur's studio. Enter a returned Tonquin expeditionist, who remarks: "I would like to be inoculated against the hydrophobia." M. Pasteur: "When were you bitten?" Expeditionist: "Well, I was not exactly bitten, but I entertain suspicions about one of the dogs which I ate."

* * The Mayor of Cincinnati proclaims that "all workmen may return to their vocations without fear of molestation." There are periods when that is in fact a good deal to assure the men, but in quiet times it does not seem very outrageous, even to the hotter heads, to let a man work when he wants to.

* * The committee on street lights in San Francisco recommend that the clerk be directed to advertise for proposals for maintaining twenty-eight electric light masts, distributed over the city, for two years from August 1, 1886. One mast is to be forty feet high, three 100 feet high, and the rest 150 feet.

* * A curious invention has turned up in Italy. It consists in the application of light-giving materials to printing ink, by which print becomes luminous in the dark, so that in the future it will be possible to read at night, in bed, or during a journey, without the assistance of candle or lamp. A new daily paper, in which this luminous material will be used, is, it is said, about to be published at Turin.

* * The subscription books for the South Side Electric Railway, Pittsburgh, have been opened. The capital stock is $60,000, and the officers of the company are Thomas Evans, President; Henry Staum, Treasurer; J. W. Patterson, Secretary; A. H. Heisey, Theo Ortman, J. P. C. Campbell, Directors. The road is expected to start near the South Side Market House and go up over the hill to the top of Mt. Oliver.

* * The recent invention by Dr. J. O'Dwyer of New York, of a new method of treatment to take the place of the dreaded recourse to tracheotomy in diphtheria and membranous croup, bids fair to be of the greatest importance. His method does away with cutting-instruments entirely, and consists simply in the insertion of a tube of peculiar shape between the vocal cords, thus permitting the ingress of air into the trachea. The results already reached by this intubation treatment compare very favorably with those from tracheotomy, as regards the saving of life; and if, on extended trial, they are borne out, the invention will be ranked with the more important ones of the century, in medicine.

* * The lake steamboat City of Cleveland is lighted from stem to stern with incandescent electric lights. The entire plant was furnished by the Brush Electric Company, of Cleveland. The plant consists of two of the new pattern, self-regulating dynamo machines, one having a capacity of 300 lights, and the other of 150 lights. Two Armington & Sims engines, specially built for low steam pressure, form a part of the plant. The steamer is wired with several independent circuits, and a fine system of switches enables the engineer to control any of the lights from the dynamo room. The steamer is very brilliantly lighted; as may be imagined from the size of the plant. Swan lamps of standard sixteen candle-power are used, and each stateroom is furnished with an etched lamp, giving a soft, mellow light. The main saloon has four magnificent electroliers, each carrying nineteen electric lamps.

The Conservation of Energy.

During the period of the revival of learning in Europe there were many who spent time and money searching after the philosopher's stone, or, in other words, a method by which cheap metals, as lead, iron, etc., could be turned into gold. The men who attempted this were called alchemists, and their work, though fruitless in the direction in which they worked, laid the foundation of modern chemistry.

In the early days of Spanish discovery and conquest the search for some means of producing everlasting youth was vigorously prosecuted.

It was not, however, until the introduction of the steam engine had made evident many uses for the employment of power that much attention was paid to the question of motors. Then at once many entered the field of experiment, with a view of devising suitable mechanism which would run without stopping—perpetual motion—not noticing that a device which so banished resistance that motion would not be checked would be of no value in doing work, for work is motion against resistance, and, if any resistance be applied to the mechanism in perpetual motion, the movement would thereby be stopped. But many of the perpetual-motion students in reality desired to set machinery in motion without employing any power other than that generated without cost by their machine, which was always on the point of being perfected. The diffusion of knowledge on scientific matters has only in a moderate degree withheld the public from investing in such will-o'-wisps.

The combustion of fuel has been much improved in the last fifteen years, and furnaces and appliances have been devised that have permitted a very high economy in the running of steam plants. There is in a ton of coal, we might say, a given amount of heat, and, when the waste products of combustion leave the boiler only a few degrees higher than the temperature of the coldest part of the boiler, the maximum of economy is attained. Claims have been advanced for contrivances whereby such perfect combustion was attained that all the ashes were consumed. Bearing in mind the principle in regard to the heat of the gases when leaving the boiler, it will be seen that at present a near approach to maximum economy is attained. A furnace which is claimed to burn the ashes usually burns the boiler.

The dynamos at present in use convert between 90 and 95 per cent. of power used in driving them into electric current. When it is considered that it is impossible to convert all the power into current, as the friction of the bearings, brushes and the air consumes a small amount, it will be seen that present machines leave little room for improvement.

When it is claimed that a certain device makes it possible for a dynamo to give enough current from one horse-power to run six arc lights, it should not be forgotten that the current for the six lights would give in motors in use at the present time fully two horse power. Why not, then, let the motor run the generator? Would there not be one horse-power to spare for outside use? That this can never be done may be safely predicted.

It is a well-established principle of modern science that energy can neither be created nor destroyed. The energy in coal or in falling water or moving wind can be changed or converted into heat energy, or electric energy, or light energy, or energy of motion. And any form of energy can be converted into any other form. But in the conversion some energy is always converted into heat, which, though not destroyed, does not change without apparent loss into any other form of energy.

When any wonderful plan for utilizing some new power in nature is brought forward, it should be first decided whether an attempt is made to generate energy or to convert one form into another.

Suppose, for the sake of argument, it were possible to keep machinery in motion without using some outside force to set in motion the engine, we could then, by checking to a certain degree the motion, convert that motion into heat. Examples of the change of motion, when stopped, into heat are familiar to us all. By generating motion, as above supposed, and arresting the motion by means of a tight bearing, for instance, we could obtain any degree and any amount of heat enough to make it too hot for the human family, cranks included.

Early History of Steam Power.

About 280 years B. C., Hiero, of Alexandria, formed a toy which exhibited some of the powers of steam and was moved by its power.

A. D. 450 Anthiemius, an architect, arranged several caldrons of water, each covered with a wide bottom of a leather tube which rose to a narrow top, with pipes extended to the rafters of the adjoining building. A fire was kindled beneath the caldrons and the house was shaken by the efforts of the steam ascending the tubes. This is the first notice of the power of steam recorded.

In 1543, June 17th, Blasco D. Garoy tried a steamboat of 209 tons with tolerable success, at Barcelona, Spain. It consisted of a caldron of boiling water and a movable wheel on each side of the ship. It was laid away as impracticable. A present, however, was made to Garoy.

In 1650 the first railroad was constructed at Newcastle on-Tyne.

The first idea of a steam engine in England was in the Marquis of Worcester's Century of Inventions, A. D. 1663.

In 1710 Newcomen made the first steam engine in England.

In 1718 patents were granted to Savery for the first application of the steam engine.

In 1764 James Watt made the first perfect steam engine in England.

In 1736 Jonathan Hulls set forth the idea of steam navigation.

In 1778 Thomas Paine first proposed this application in America.

In 1781 Marquis Jouffroy constructed one on the Saone.

In 1785 two Americans published a work on it.

In 1789 William Tymington made a voyage in one on the Forth and Clyde canal.

In 1802 this experiment was repeated.

In 1782 this Ramsey propelled a boat by steam to New York.

In 1783 John Fitch, of Philadelphia, navigated a boat by steam on the Delaware.

In 1792 Robert Fulton first began to apply his attention to steam, and soon after the Clermont, the first really successful steamer, was plying on the Hudson.

Leather Belts.

By Scott A. Smith, of Providence.

Leather, in the process of manufacture, previous to the application of grease, has little strength, and may be torn, according to thickness, much like brown paper. Grease causes such action of the fibres upon each other that great strength comes back; in fact the leather may be said to return to a condition akin to its original state as a hide.

The ever-fertile mind of the American worker in belt leather has sought for new methods in the greasing process to gain in value of product, but to this day a universal method exists of using tallow and cod oil; these two are usually combined for the flesh side, while cod alone is used on the grain. They are allowed to slowly penetrate the leather, which has first been thoroughly wet; the hides are hung in the open air, or in a drying room, and as the water dries out the grease penetrates, leaving, however, the sterine of the tallow, which latter is finally scraped off. The further manipulation consists in wetting and stretching, rubbing down or stoning; finally, much working on the surfaces with a slicker, and trimming.

A just limit to the quantity of grease which belt leather shall have has been well determined, to give it a character of elasticity and toughness peculiar to no other material.

It is an interesting fact that the best cod oil contains only a faint trace of an active acid. Also, in using tallow, the active acid principle, the stearine, is left upon the outside to be scraped off; thus all which penetrates is of a neutral nature and not injurious to the fiber.

Belting is now made and carried in stock in large rolls, and by long standing it becomes dry. When a new belt is put to work upon pulleys there is a rigidity in its character not in keeping with our ideas of a minimum of power to be expended; ordinarily, also, when a belt is put to its largest duty, there is more or less slipping.

In the first making of iron-faced pulleys, they were left rough, but pulleys were soon made as smooth as possible by finishing, a belief prevailing that a close contact between leather and iron gave the best adhesion; and then, too, if slipping occurred, less wear came to the surface of the leather. To provide for still better adhesion, pulleys are covered with leather, also with patent covering of paper. There have again come into use pulleys made with iron arms and wood rims, also all wood pulleys.

To prevent the slipping of belts, or to make them more pliable and durable, various substances have been used; powdered rosin to produce immediate adhesion, or castor oil to give pliability and adhesion. The first is proved by all experience to be very injurious to leather, causing it to harden and crack. Castor oil has been much used, but never with entire satisfaction, where all conditions of a belt are considered. Castor oil has an active acid principle; also it is drying in its nature; its continued use saturates a belt and changes its nature from its legitimate state of elasticity and toughness—a belt thoroughly filled with castor oil is in a poor condition when it comes to repairs.

The writer has given much close study to the care of leather belts, with respect to a proper dressing to apply to them, and after eight years' experience has produced a neutral compound which thoroughly prevents slipping, while still leaving the leather practically as it comes from the belt-maker's hands. Its endurance is very remarkable, and the quantity necessary to prevent slipping is surprisingly small; it leaves nothing further to be desired.

The writer does not hesitate to say that with a polished-face iron pulley the full value can be had from a leather belt.

Whatever the conditions of use for belting, it should be positively kept free from machinery oil, and free from dust, so far as possible. Run the grain side to the pulley. Belts should be run as slack as possible, without, however, so much slackness that a flapping motion can exist; this keeps the fibers from undue strain, saves the laced joints, saves the bearings from unnecessary wear, and perhaps, above all, prevents the shafting from being pulled out of line.

The inquiry is made as to the exact cause of the electricity developed by belts. As I have observed that, even in the extreme case of a dynamo belt, running over two-thirds of a mile per minute, no electricity is developed in the belt when my belt dressing is used, the question seems legitimately asked if the electricity in belts does not come only with slipping.

In closing, the writer solicits correspondence with persons experienced in the use of belts, and promises a further communication on this subject.

* * An electric light company has been formed at Media, Delaware, and a plant will be put in at once. They will erect a suitable building, putting in two engines, probably 60 and 80 horse-power, with sufficient boiler-power to meet any demands for some time to come. A number of the citizens are contemplating putting the light into their residences. The company expect to be running inside of three months.

* * The London *Electrician* is the authority for a new and easy method of relieving the toothache. It says that if a thin plate of zinc be placed on one side of the gum and a silver coin on the other side, with the aching tooth between them, and then the edges of the metals brought together, a weak galvanic current will be established that will cure the pain. It looks possible, and is the sort of thing that one could easily get somebody to try.

The French Steamer "La Champagne" and Her Electric Light Plant.

The new steamer "La Champagne" of the Havre line sailed from New York on its first return trip last Saturday. While in port a representative of the ELECTRICAL REVIEW, through the courtesy of Louis De Bebian, Esq., agent of the line in this city, inspected the extensive and highly interesting electric light plant on board. Mr. Auguste François, the electrician of the steamer, who has charge of all the electric work, very kindly conducted the REVIEW representative over the vessel and explained the various points of interest.

This is undoubtedly one of the most complete steamer installations ever made, and both on account of the details of the appliances used and the general arrangement of the machinery is of interest, and deserving of special mention. A very gratifying fact to record also, is that the steamer depends for light entirely on electricity, no other method of illumination being provided.

The electric light in this case is not a luxury, found only in the first-class cabin and saloon, but is distributed through all parts of the vessel, and it is probably most appreciated by the stokers and steerage passengers as it certainly must add very materially to their comfort because of the little heat given off by the lamps, and because the use of them does not increase the vitiation of the atmosphere already bad enough in these parts of an ocean steamer.

The dynamo room is amidships on the port side, and is about forty feet long by fourteen feet wide. Here are three Breguet dynamos of 110 volts E.M.F., rated for 250 amperes each, driven direct by a vertical compound engine of 40 horse-power capacity manufactured by Weycher & Richmond. 250 16 candle-power, and 380 10 candle-power Swan lamps are mounted, the wiring system consisting of 17 independent circuits all starting from a main switchboard in the dynamo room, at which point the lights in any part of the vessel can be controled.

One striking feature of this plant is the manner of transmitting the power from the engine shaft to the dynamo shaft. The armatures of the dynamos are driven at the remarkably low speed of 226 revolutions per minute; this avoids the necessity for belts, as the engines can run at even greater speed than that with perfect safety. The device for connecting the engine shaft to the dynamo shaft consists of two steel disks of equal diameter facing each other, one on the end of each shaft. On each of these disks are an equal number of projecting ears arranged in circle, those on the engine disk being close to the periphery, while those on the dynamo disk are about three inches nearer the center and in the same radii as those on the engine shaft disk. Very heavy rubber loops are sprung over each pair of ears in the same radii, thus making a perfectly strong and reliable connection, and at the same time one having enough elasticity to overcome many of the objections to driving dynamos by direct connections.

Mr. François stated that this device so far has proved entirely satisfactory in its operation.

On each dynamo outside the bearing on the commutator end is a small pulley from which is driven a tachometer, which enables the attendant at a glance at any time to see the number of revolutions the armature is making. The mains from the three dynamos are carried to the main switchboard, where they are coupled in parallel circuit, and where each one can be connected or disconnected at pleasure by a suitable switch.

More than two of them are never run at one time, the third dynamo being in reserve. The seventeen circuits are arranged in two divisions—"Tribord" (starboard) circuits and "Babord" (port) circuits. A bolt meter is attached to the switchboard, arranged in such a manner that at that point the E.M.F. of any circuit can be taken.

The E.M.F. required at the lamps to bring them to their proper candle-power is 102 volts, and the current necessary, 0.5 amperes for the 10 candle-power, and 0.7 for the 16 candle-power lamps.

On each end of the switchboard is a current indicator capable of measuring the full current from one machine, and a switch convenient for shunting it in and out of circuit. Above the dial of each indicator is an index giving the amperes at each division of the scale so that the attendant can tell the current flowing without making any calculations.

In order to increase the durability of the lamps the terminals at the dynamos are changed every morning, so that the positive wire of the day before becomes the negative, and *vice versa*. Mr. François stated that so far the average life-time of the lamps had been about one thousand dollars. The fixtures throughout the vessel are substantial and well designed, and in the first-class cabin, saloon and staterooms are quite ornamental. In the steerage and other places where the lamps would be apt to be handled by ignorant people, the switches to turn the lamps on and off can only be operated by a key which is kept by the electrician. The lamps are protected by heavy wire guards, and in some places where, when the ship is rolling, there would be danger of loose articles being thrown against them, by cast iron gratings, so made, however, as not to interfere seriously with the light.

The wiring seems to be well done, and in most places is completely concealed, and the disposition of safety plugs and gang switches in the circuits seems to be complete and convenient.

In making a comparison of this installation with one of the same character made by any one of the leading electric companies of the United States it seems to us that it has some points of superiority which it would be well for our experts to study. On the other hand this installation is certainly inferior in elegance of design and finish of the various detail devices of the system to any one of our first-class systems and the fixtures are not so artistic as our best manufacturers would design for like purposes.

In addition to the electric light Mr. François had under his charge a small telephone system, and has himself constructed an ingenious electrical system of indicating in the pilot house the exact position of the rudder.

The telephone is the Crosslee system and consists of two circuits to the pilot house, one from the steering gear in the stern, and one from the engine room. The transmitter used in this system is constructed from two carbon disks separated by a ring of ebonite, the central space being filled with finely powdered carbon.

Taken altogether, the electrical appointments of the vessel are first class, and one cannot make an inspection of her without being impressed by the constantly increasing importance of the part which electricity is playing in the drama of modern civilization.

—— An electric light plant is to be established in Pensacola, Florida.

—— Mr. N. J. Symonds, Woburn, Mass., has ordered a 12x12 Armington & Sims Engine from the Jarvis Engineering Company, to run incandescent lights.

—— The electric light plant in Jacksonville, Fla., owned by Dr. Cloud, has been sold to the owners of the gas company, and will be known as the American Electric Illuminating Company, of Jacksonville. The new company includes Messrs. S. B. Hubbard, John Clark, W. A. Macduff, A. D. Stevens, and H. H. Tibballs, Mr. Hubbard being the principal stockholder.

—— An esteemed correspondent of the REVIEW, Mr. T. S. King, of Minneapolis, Minn., writes us that the statements appearing in the REVIEW in the interview with a Cleveland gentleman concerning underground wires in Minnesota were incorrect. He writes that as far as Minneapolis and St. Paul are concerned, there is "not an inch of electrical wire buried, not a contract let for burying the wires nor any present prospect of their being buried."

Springfield's 250th Anniversary Celebration, May 25, 1886.

[Special Correspondence of the ELECTRICAL REVIEW.]

It is significant that in all the great events that have taken place within the last few years that the applications of electricity have been prominently connected with the great occasions of the day. In the recent celebration at Springfield the new illuminant was an important factor in the decorations. The dynamos furnishing the current were two 6-ampere 45-light machines. The lamps were disposed in multiple series, the connections being made in such a way that a close examination was required to disclose the fact that they were not placed in multiple arc.

Central square was brilliantly lighted by 250 incandescent lamps (one for each year of the settlement) of the Sun Company, to whom is due the credit for the success of the exhibition.

The lamps were disposed in conformity with the decorations, and were placed in trees and in every direction. Groups of lamps were on extemporized electroliers, the lamps, being placed in concentric rings forming a double-ended cone, were placed at various points in the square. The artistic and electrical engineering involved in the display was of the most creditable character, and was an evidence of great ingenuity. The festooning of the lamps was picturesque, and showed what a high-tension current in the hands of competent engineers is capable of accomplishing. The brilliant effect and enthusiasm engendered thereby was fully demonstrated to the astonishment of 10,000 people, who were gathered to witness the effect of the modern illuminant that has made such gallant strides in the past few years. Leaving this fairy scene and passing to the Town Hall, eventful in the history of Springfield, and there our eyes were regaled with one of the most brilliant practical exhibitions of the incandescent light in the form of great electroliers of powerful lamps. In this hall there were three extemporized electroliers, with six 125-candle-power lamps each. The reflectors overhead consisted of large Chinese umbrellas, lined with yellow satin, and underneath the whole, running from end to end of the room, was a yellowish, indistinguishable gauze that assisted in creating the beautiful effect that was experienced by the dancers underneath.

Standing at one end of this ancient edifice, which was for the time being used as a ball-room, the scene was most brilliant. The soft yet full blaze of the electric lamps, combining with the manifold tints of the decorations together with costumes of the dancers, tended create an impression that language is almost inadequate to express.

Other public buildings were illuminated in the same manner, and the whole work of the installation was accomplished in fourteen days. So satisfactory and gratifying was the display that the lamps have been retained, and the city has voted compensation to the local company for the work, whereas the whole undertaking was carried out solely as an effort on the part of the company to assist in the celebration. F. M. G.

Springfield, Mass., May 25.

—— The building of the Royal Electric Company, Montreal, was burned down May 26. The building was owned by Mr. Wm. Smith, and was a most substantial one. The total damage will amount to about $50,000, covered by insurance, divided among several of the city companies. The Salvage corps did effective service by spreading a number of covers over dynamos and other valuable stock. This company has been unfortunate in this regard since it was established in Montreal. The building on Dowd street, formerly occupied by them, was burned down, and during the flood they were inundated in the building which was destroyed by the last fire. The company has a contract to supply the city with electric light within forty days. An employe says that as the dynamos and engines are saved they would use their efforts to have the lights burning as usual the following night.

ELECTRIC LIGHT NEWS

—— The Milford Electric Light and Power Company has been incorporated in Milford, Mass.

—— The city council of Urbana, Ill., is considering the use of electricity for street illumination.

—— The Charlestown (Mass.) Gas Company desire to be authorized to furnish electric light.

—— The electric light has now superseded gas as an illuminant of the streets of Poughkeepsie, N. Y., and the citizens are happy; 130 lamps are used, and eight dynamos have been put in. The company's contract runs for one year.

—— Mr. Fred. A. Gilbert, of New Haven, has been elected president of the Merchants' Electric Light Company, of Boston. Mr. Gilbert is as well supplied with presidencies as any one man in this country, and all of them are electric lighting companies. At the present time Mr. Gilbert is president of the New Haven Company, the Bridgeport Company, the Newport Company, and the Merchants, of Boston.

—— A commission has been appointed in France to consider the regulations that should hold good for the installation of electrical conductors. By decree of the 24th of April the following gentlemen formed the commission: MM. Marcel Deprez, Lemonnier, D'Arsonval and Violet. The commission will prepare rules and fix the technical conditions in order to assure the security of the public in the installation of conductors affecting the transmission of electrical energy.

—— The electric light is sunlight. Plants do not increase in weight and increase in amount of carbon, except in the sunlight. Years ago the surface of the earth was covered with a luxuriant vegetation, which by the help of the sun's rays took from the carbonic acid gas in the atmosphere the carbon, which became a part of the plants, and gave off to the air the oxygen. As the earth cooled, the surface was bent in many places, and the plants and trees, which covered the ground to the depth of many feet, were pressed into a compact mass, and when acted upon by the heat from the interior of the earth, were changed into coal. This coal, which we use for generating steam for electric plants, is stored sunlight.

—— Taggart Bros., of Watertown, N. Y., manufacturers of manilla paper, who have been using the Sawyer-Man system of incandescent lighting, write to general manager Davis, of New York City, as follows: "We have had your system of incandescent electric light in our paper mill for the last five months, and it has given perfect satisfaction. The lamps which you guarantee to last six hundred hours have now run about two thousand hours, and we have only had four lamps burn out. The plant has been running about fourteen hours a day. The dynamo runs nicely, and requires very little care to keep it in order, and, on the whole, the plant gives entire satisfaction."

—— According to the *Diamond Fields Advertiser*, South Africa, the electric light played an important part in the criminal proceedings relating to the dynamite conspiracy. According to one of the witnesses, he was able to identify the accused because the latter got directly between him and an electric light, which was at a distance of some 360 yards. The witness said: "Any one standing in the window where I stood would catch an object coming between them and the electric light very distinctly," so that not only in America, but in more thinly populated districts, the question of more light should have some effect upon decrease of crime. It will be remembered that Mr. Preece remarked that an increase in electric lighting would lead to a decrease of policemen.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JUNE 1, 1886.

342,587 Dynamo-electric and electro-magnetic machine; Rudolph Eickemeyer, Yonkers, N. Y.

342,588 Dynamo-electric and electro-magnetic machine; Rudolph Eickemeyer, Yonkers, N. Y.

342,589 Dynamo-electric machine; Rudolf Eickemeyer, Yonkers, N. Y.

342,594 Storage battery; Charles D. P. Gibson, New York, N. Y., assignor to the Gibson Electric Company, same place.

342,646 Manufacture of bichromate of potash; William Simon, Baltimore, Md., assignor to the Baltimore Chrome Works, same place.

342,647 Process of manufacturing ammonium bichromate; William Simon, Baltimore, Md., assignor to the Baltimore Chrome Works, same place.

342,666 Electro-magnetic transmitter; John T. Williams, Mount Vernon, N. Y.

342,694 Insulating and protecting electric wires and cables; John W. Hoard and Frederick R Hoard, Providence, R. I.

342,748 System of electrical distribction; John W. Howell, New Brunswick, N. J.

342,751 Electrical connecting device; Edward H. Johnson, New York, N. Y., assignor to Bergmann & Co., same place.

342,775 Telephone transmitter; Alfred Beale, New York, N. Y., assignor to himself, L. B. Clark, same place, and E. R. Wiggin, Boston, Mass.

342,777 Apparatus for measuring electric currents; Phillip Cardew, Chatham, County of Kent, England.

342,872 Electrical stopping device for motors; Edwin Leigh and Thomas Townsend, Fall River, Mass.

342,881 Induction telephone repeater; Sidney F. Shelbourne, New York, N. Y.

342,892 Conductor of electricity; Edward G. Acheson, New York, N. Y.

342,947 Induction coil; Alfred M. A. Beale, New N. Y., assignor of two-thirds to Lemuel B. Clark, same place, and Edwin R. Wiggin, Boston, Mass.

343,008 Device for controlling the movements of the armatures of electro-magnets; Charles L. Clarke, Orange, N. J.

343,014 Means for preventing disturbances on telephone lines; John E. Dann and John Sapp, Honeoye Falls, N. Y.

343,017 System of electrical distribution; Thomas A. Edison, Menlo Park, N. J.

343,042 Automatic printing telegraph; Edward J. Mallett, Bay Side, Long Island, N. Y.

343,043 Automatic telegraphy; Edward J. Mallett, Bay Side, Long Island, N. Y.

343,044 Automatic telegraphy; Edward J. Mallett, Bay Side, Long Island, N. Y.

343,053 Automatic regulator for incubators, etc.; Preston C. Morse, Natick, Mass.

343,076 Electrical railway; Sidney H. Short, Denver, Col.

343,081 Process of making electric cables; John Joseph Charles Smith and Michael Smith, Passaic, N. J.; said John Joseph Charles Smith assignor to John H. Cheever, New York, N. Y.

SPECIAL NOTICE.

National Electric Light Association,

SEMI-ANNUAL MEETING.

THE FOURTH MEETING—semi-annual—of the NATIONAL ELECTRIC LIGHT ASSOCIATION will be held at DETROIT, MICH., on Tuesday, 31st day of August, at 10 o'clock, A.M. Dues being payable in advance, all members are required to forward the same for the year 1886, by check or otherwise, payable to the order of J. F. MORRISON, President, Baltimore, Md.

Electric Light Companies and Manufacturers of Electric Light Apparatus, Supplies, &c., desiring to become members, must apply on or before August 31st, to the President, J. F. MORRISON, Baltimore, Md.

Members and others desiring information as to R.R. transportation rates will address J. F. NOONAN, Esq., Chairman Com. on Transportation, Paterson, N. J.

Special Hotel rates will be made known previous to meeting of the Association.

A. J. DeCAMP, Chairman Ex. Com.
Philadelphia, Pa.

BUSINESS NOTICE.

To Members of the National Electric Light Association.

A meeting of the Executive Committee of this Association will be held at the Hotel Dam, New York, June 29. All persons who expect to prepare papers for the Detroit meeting, or who may have any facts of interest to the Association that they desire to present, are requested to notify the committee at this meeting; addressing as above.

A. J. DECAMP,
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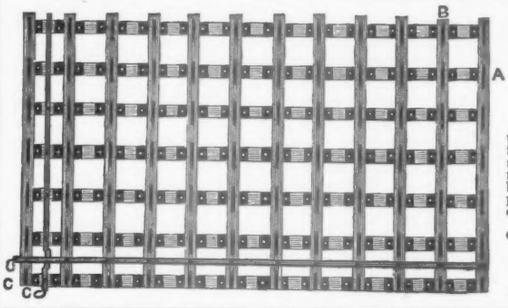

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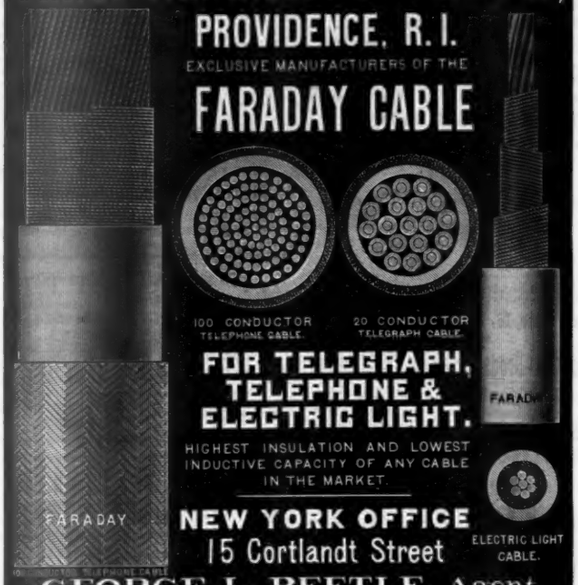

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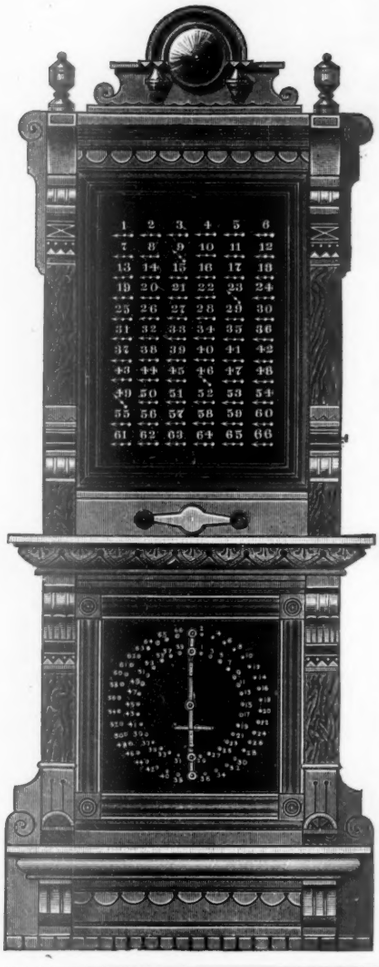

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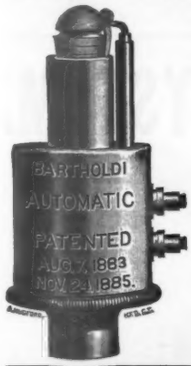

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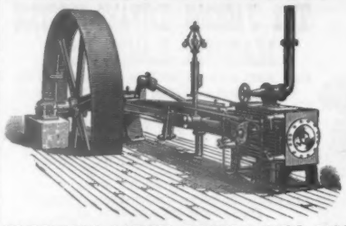

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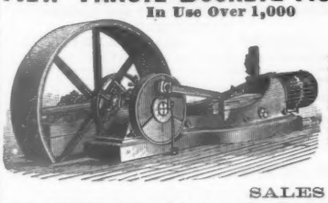

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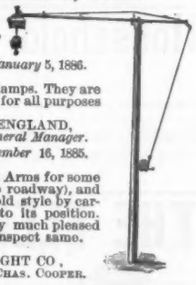

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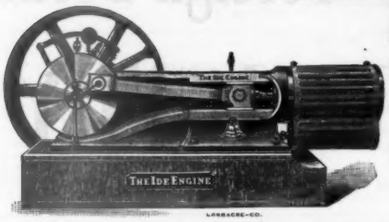

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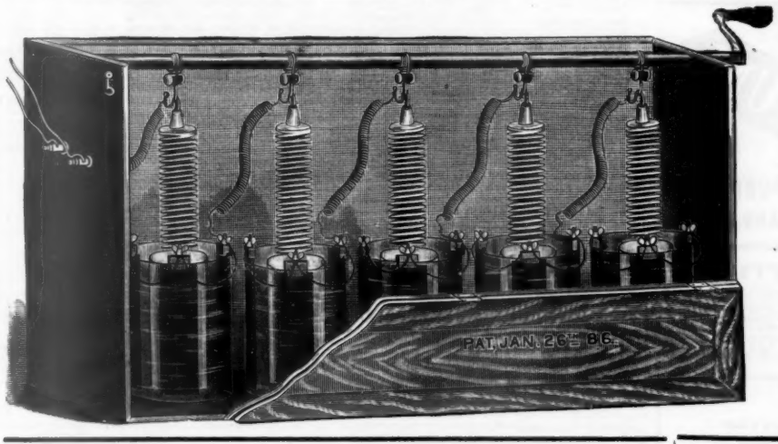

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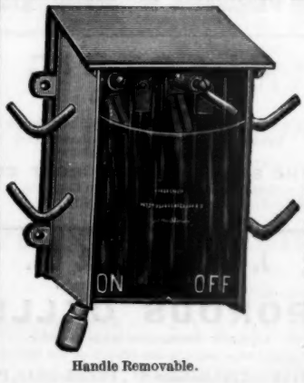

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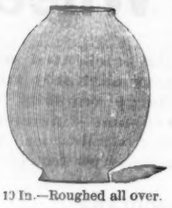

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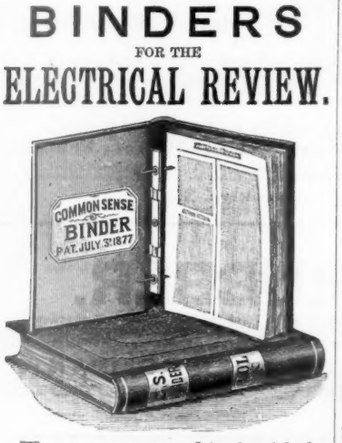

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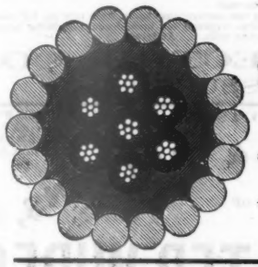

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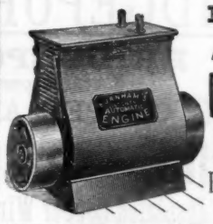

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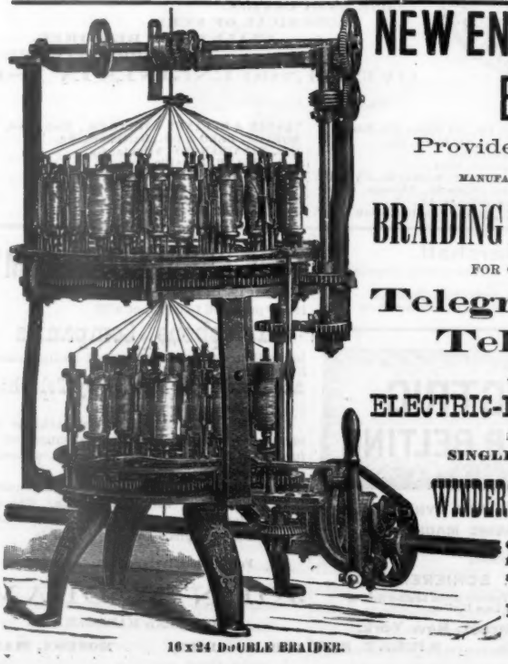

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